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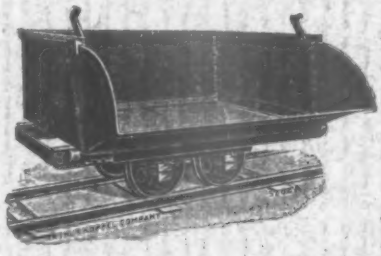

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MUNICIPAL ENGINEERING

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COST OF REINFORCED CONCRETE BUILDING CONSTRUCTION.

By Louis H. Gibson, Architect, Indianapolis, Ind.

James J. Hill, of the Northern Pacific Railroad and withal a great economist, statistician and brilliant writer on subjects of interest to the commercial world, has said that the end of fifty years will see the "Ironless Age." Maybe, but may not that period when there will be no metal be postponed through the use of cement? Mr. Hill, a very wise and very efficient man, may not have realized the possibilities in the use of cement as an economical agent and its relation to the saving in the use of metal. Many structures are built with cement and metal which do not consume more than three per cent. of the metal that would be required if steel alone were used. Be this as it may, we find ourselves at the beginning of the "Cement Age" and near the beginning of a "Woodless Age."

The price of framing lumber is now such that one may well consider the question of the use of concrete and steel. There are conditions where the concrete-steel structure will cost less money and it always cost much less than steel with fire-proofing other than concrete.

This statement with regard to the relative cost of the materials named is not loosely made. It is based on an extensive practical demonstration. Some months ago the writer was employed as the architect of a large factory—a building 500 feet long and 187 feet deep at its wings. The material recommended to the owners was concrete-steel. The preliminary estimate from the office of the architect indicated slow-burning construction of wood to be more expensive by five per cent. and the actual bids on the work by contractors indicated a greater difference than that shown by the preliminary estimate. The owners of the property, in their eagerness to be fully convinced that they were getting not only the best but the cheapest, had drawings and specifications made for joist construction with wood girders and posts, joist construction with steel girders and posts, slow-burning construction with planking, beams, girders and posts of wood, slow-burning construction with wood planking and beams and with girders and posts of steel. In connection with these various combinations, walls of brick and cement block were considered. In every instance, the comparison not only resulted favorably to the concrete construction in the matter of cost, but bred in the minds of all a determination that, from every point of view, the concrete-steel construction was superior. That is, concrete-steel is not only the best, but the cheapest. So it must be when a relatively new medium, structural or otherwise, comes into being. It must not only have superior merit, physically, as compared to other good things, but, in order to receive early recognition, it must be obtainable at a cost as low as or lower than the best competitive material. No product intended for the market can made rapid progress on any other basis.

It is not necessary to go into absolute details as to the cost of this structure in order to make a clear showing. It is sufficient to say that in the first figures the cost of this structure, as a concrete-steel building, approximated $42,000, in slow-burning construction of wood, $45,000, and steel frame construction went well beyond this figure and this without fire-proofing.

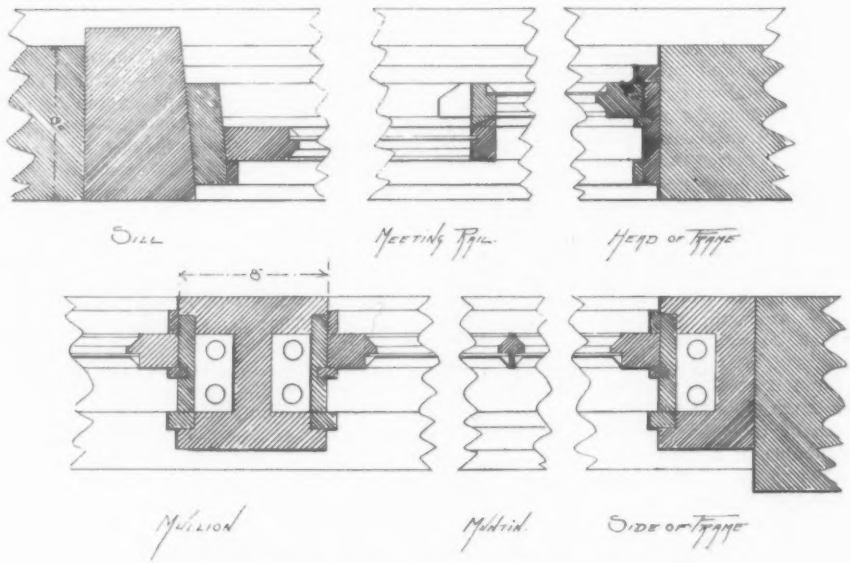
The work of taking these figures and considering and making plans and specifications was educational not alone to the owners of the structure, but also to the architect. It gave him freedom and courage that he would not otherwise have had in dealing with a new client. So it was that from an early determination to contract all the work, it was eventually decided to do it by the day; to bring all of the material and put it in place by local labor under competent supervision. The result has been not only a high grade of

workmanship, but at a cost well below that of any contract proposition. Broken stone, gravel and sand were obtained locally and the steel members purchased on the basis of specific requirements.

Before explaining structural details, it may be well to consider the question of insurance which was considered as one of the determining factors as to material of construction.

In this structure, the cost of insurance was considered before a shovelfull of dirt was moved, and with astonishing results.

It is well to bear in mind in building



DETAILS OF CONCRETE SETTING OF WINDOW FRAMES.

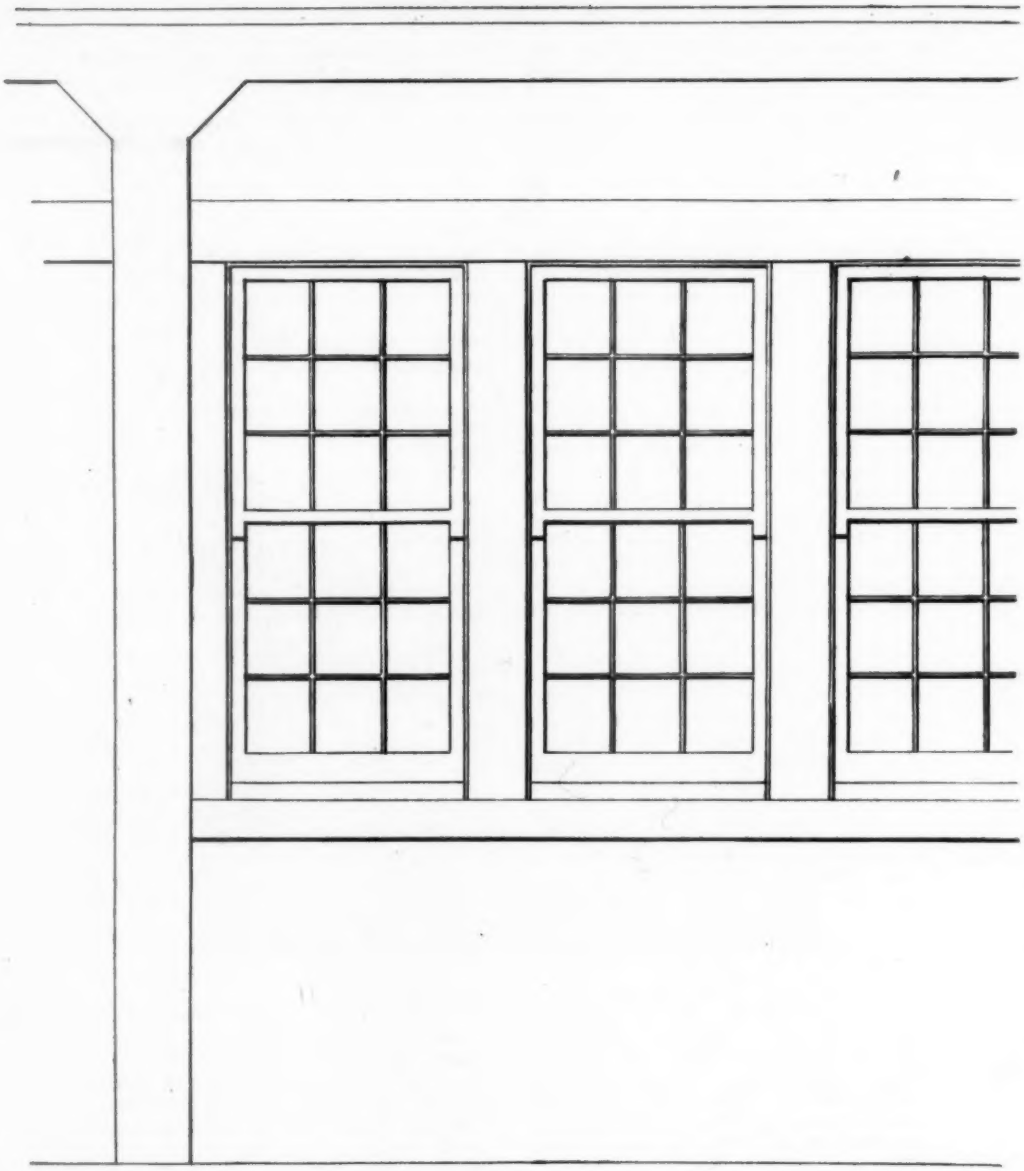
that there are two elements in the insurance question, one of which relates to loss of property by fire, and the other which relates to loss of business. Again, it must be observed that there is a definite relation between the cost of insurance on the building and on the stock which it contains.

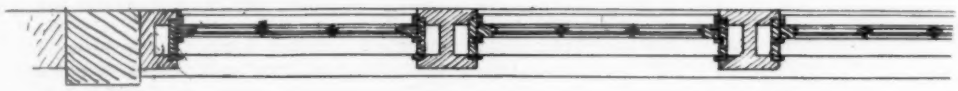
The owners of this property and their architect took no chances as to what the result would be. They met the managers of various mutual organizations with the purpose of having plans carefully examined and criticised from the underwriters' standpoint. The result showed that the insurance buga-boo is a buga-boo indeed, in so far as relates to factory risks.

Estimates were made by the various organizations and indicated that it was up to the owners and the architect as to just what the insurance would cost. Under certain conditions of protection and construction the estimate was forty cents per hundred dollars at risk, and under certain other conditions, eight cents per hundred dollars at risk. The latter estimate was made by the Boston Manufacturers Mutual Fire Insurance Company, of Boston, Massachusetts, and was on a protected cement-steel structure. The actual disposition of the insurance has not yet been made, but here again the educational results of investigation through right sources was apparent. The owners of this property have determined to carry very little insurance on this risk and that largely on the stock. Here is a saving not only in the percentage cost of insurance, but also on the amount to be carried. This company has had the experience of being burned out before and is not apt to be indiscreet in this matter.

In this structure there was involved the work of the structural, mechanical and insurance engineer, and not the least of these was the insurance engineer.

In Indianapolis, the fire tax is twice as large as the municipal tax. The fire tax is made up of insurance and protection costs. It may be assumed that Indianapolis is not an exceptional instance but rather a typical one. This city is mentioned because the writer took the trouble to go to the city records and get taxables represented by improvements, and stocks





CONCRETE FACTORY WALL SHOWING WINDOW CONSTRUCTION.

in buildings and relate it to the insurance premiums and the cost of the fire department.

The fire loss in Indiana to the insurance companies alone and without relation to the insured or to the protection cost is about fifty-seven cents per $100 at risk. This, when compared with a possible rate of eight cents per $100 at risk on a hazardous risk, shows that our immense fire tax is as unnecessary as it is wasteful. The fifty-seven cents loss to the insurance companies in Indiana is probably typical of the average loss in the United States.

It must not be assumed that cement-concrete construction alone is responsible for this saving. It was a very helpful factor, but is associated with protective apparatus. Again, this saving in cost is not wholly in terms of percentage, but as well by volume of insurance to be carried, which latter saving is largely owing to the use of cement. The Boston Mutuals have $225,000,000 at risk and their fire loss within the last five years has been less than four and one-half cents per hundred dollars at risk.

As said before, the labor work on this structure was done by the day. This gave an opportunity for careful analysis of results, and a chance to experiment which would not have been possible or desirable under contract conditions. The work of making concrete was particularly satisfactory in its results. There were no arbitrary standards of proportions of broken stone, gravel, sand and cement.

The voids were reduced to a minimum in the mixture of the aggregate, i. e., in the stone and sand, and the voids therein and proper excess was taken as the volume for cement. This made a particularly strong concrete as only the necessary amount of cement was used. The concrete was not weakened by using an excess of cement.

The voids were first determined in the broken stone or gravel and then the volume of the voids therein was supplied by fine gravel and sand, the voids remaining being the basis for the determination of the amount of cement.

Not only was the quality very satisfactory, but the cost was less than it would have been under the usual rough and tumble method of making concrete.

Before the engineering possibilities of concrete-steel work will have been determined, we must realize that the proportion of cement in concrete must be the lowest normal amount possible, and that the mixture of the inert material, the gravel, stone and sand in a manner to reduce the voids is quite as important as any other single process. The addition of cement may be normal or abnormal. There may be too much cement or not enough.

The walls of this structure are of concrete blocks. The window frames, as indicated by the drawing, are made with cement and wood. The advantage of a cement block in a window frame is twofold. It reduces the amount of wood to a minimum and gives a maximum amount of glass.

In the design shown, the separation is only eight inches. With a different design of frame, the separation would be at least ten and one-half inches and with an exposure of that much wood to the action of fire.

It will be seen that the weights for the sashes run up and down in the box formed in the cement. The cement box frame has great insurance value over wood or metal. An eight-inch mullion of brick for box frame windows would not be possible. Again, the form of the cement part of the frame is admirable as a supporting column for superimposed weight.

The pulley style and sash might be made of galvanized metal and in this way still farther reduce the fire hazard.

The cost of an all wood frame and mullion and the combination of wood and cement is, under normal conditions, the same.

SAND LIME BRICK MANUFACTURE AND USE.

Brick made of sand and lime and hardened in the air are probably as old as the use of sand-lime mortar. These brick take many months to harden and their manufacture has never attained any great development. Their use has been confined almost exclusively to communities where there was no clay from which clay brick could be made, but where an abundance of sand could be found. The chemistry of the hardening is similar to the chemistry of mortar hardening—the lime absorbs carbonic acid gas from the air and becomes carbonate of lime. No chemical reaction takes place between the lime and the sand, which remains merely an insert mass in the midst of a network of carbonate of lime.

In the year 1880, the German cement engineer, Michaelis, found that properly

mixed sand and lime in a moist state and subjected to the influence of high pressure steam a number of hours, becomes very hard and it has subsequently been demonstrated that the process of hardening is not merely a hastening of—but a totally different process from that above referred to. Under the influence of the heat of the steam in the presence of the moisture, the silica in the sand appears to attack the calcium of the lime, forming a hydro-silicate of calcium. Transparent slides of sand-lime brick under the microscope show the sand has been pitted, the appearance being analogous to that of a metal which has been in the presence of an acid. The bonding agent of this brick is, therefore, a silicate of calcium and only lime high in calcium can successfully be used.

unless the sand is fine it is advisable to grind it, if a high grade brick is to be made. As a rule, an equally good or better brick will be made with less lime if the sand is ground than if it is coarse. This is probably due to the fact that a certain density must be given to the brick, and if it is not given to it by a certain proportion of the sand being fine, more lime must be added to fill in the interstices.

The Memphis Granite Brick Company has been in operation now something over two years and has produced three million brick, most of which have been used in dwellings around Memphis. The largest single contract was that with the Memphis Street Railway Company, for three-quarters of a million brick for a street car barn, red brick being used on

A MEMPHIS RESIDENCE OF SAND-LIME BRICK.

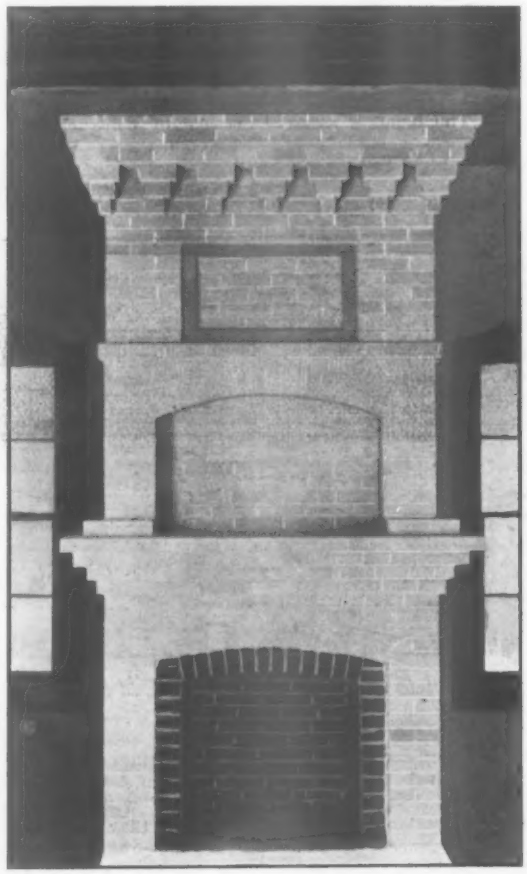
The lime must be thoroughly hydrated before it is pressed, for the process of hydration, if not completed before, is sure to become completed after it is put in the hardening cylinder under the influence of the steam, and as lime in process of hydration increases in bulk, or swells, such hydration, however little there may be of it, is sufficient to distort, crack and weaken the brick.

Some plants use only hydrated lime, either buying the lime already hydrated or hydrating it themselves. Other plants, of which that of the Memphis Granite Brick Company is one, use only quick lime and allow the hydration to take place after the lime has been mixed with the sand. Some plants grind and others do not grind the sand. If the sand has a large proportion of fine grains, say passing through a 100-mesh screen, it is probably unnecessary to grind any, but

the outside and white brick on the inside of the structure. Notwithstanding the many difficulties which the plant has had to contend with owing to improper installation, they have uniformly turned out a good product, which is steadily winning its way among the public. They make common and face white brick and common and face red, brown, buff and slate colored brick. They have also made some stone for window sills and caps, water tables, etc. Very few sand-lime brick plants in the United States turn out as good a brick as the one made here. Dry sand only is used. A large steam pipe dryer, holding in all one hundred and fifty yards of sand and making use of exhaust steam, is used. The sand is delivered into this by a bucket elevator and passes through a rotary screen at the top of the dryer, intended to eliminate all substances which might clog the

dryer or damage the machinery. After being dried the sand descends on to a belt which delivers it to the boot of the bucket elevator and it then finds its way into a small dry sand bin.

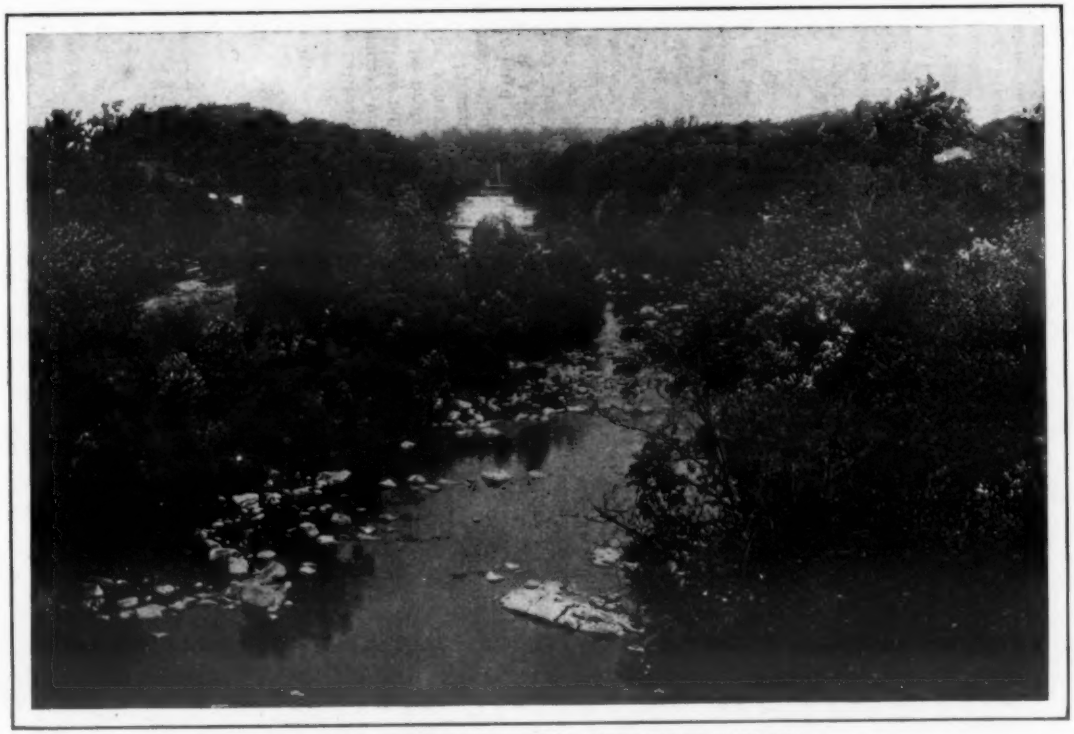
The lime is stored in a brick building with cement floor, from which it is carried by wheelbarrow to a lime crusher, from which it is elevated into a small crushed lime bin which is next to the dry sand bin above alluded to. These two materials descend into appropriate measuring apparatus so that the proportions of each entering into the mixture can be readily fixed and once fixed remain substantially permanent. The sand and lime in the proportions of about five to one go through an Abbe tube mill, which mixes and grinds both, the remainder of the sand being in its turn mixed with this mixture as it comes out of the tube mill. The proportions of the two materials in the final batch are about six per cent. of lime to ninety-four per cent. of sand. It is found best only to grind part of the sand because the greater the variety in the size of the particles the easier it is to obtain a close-grained, dense brick. This material is mixed with water and then carried by a bucket elevator to the bin, where it remains over night. The material then descends through the bottom of the bin to a belt conveyor, which delivers it to a bucket elevator and it then finds its way into a press feeder, which delivers it to a press.



FIRE PLACE OF SAND-LIME BRICK.

The hardening cylinder is seventy feet long and holds something over eighteen thousand brick. The steam pipe, as well as the hardening cylinder are covered with the best magnesia covering. An Atlas 50-horsepower, four-valve automatic engine furnishes power for the plant.

There is shed storage room at the



PARKS OF WILMINGTON, DEL. NEW FIRST DAM, 1904.

plant for seven hundred thousand brick. The sand is obtained in two ways: First, by a railroad track running on a trestle from a large unloading plant, four miles south of the brick plant, arranged to facilitate the unloading of side dump cars when the sand used was obtained in this way. The brick plant has also a small inclined track down to the river, with a hoisting engine at the top, so that they can unload direct from barges. They have storage room, without reshoveling, for twelve hundred yards of sand. They have about four hundred feet of railroad track on their yard, exclusive of the sand trestle track and many of the brick sold are shipped by rail, though there is a well graveled road leading from the plant, the grade of which is, however, rather steep.

The illustrations show a handsome residence built of white sand-lime brick, laid in yellow mortar, and a fire-place built of the same.

MODERN ROAD BUILDING.

By a Contractor.

The revival of interest in the question of good roads, which has recently spread throughout the country, after a period of indifference of over fifty years (ever since the railroads began to supersede the stage coach), brings up the question of, How shall we build them?

There is probably no subject upon which the general public have so little accurate information, and so much groundless prejudice as that of macadam roads, or hard roads. Secretary Wilson, of the U. S. Agricultural Department, has stated that the farmers of the United States waste or lose annually six hundred million dollars by reason of bad roads. This is merely expressing it in dollars, without taking into calculation the loss of temper, of disposition, of comfort, and even of life.

About twelve years ago, the state of New Jersey was the first to take up the question of building hard country roads with state aid. The first law was only passed after a most vigorous campaign, and was violently opposed by the very men who would be most benefited.

As soon as the roads were built, these very opponents of the proposition were the strongest in advocating and urging more good roads. Good roads are an education in themselves, and the history of the movement in New Jersey has been absolutely universal. In no case has such a movement had any other effect than a wider and wider demand, and the farmers were most astonished of all to find that the value of their farms rapidly increased from 20 to 40 per cent., or from four to ten times the increased tax for good roads, chargeable to their farms.

Indiana began this fight for good roads in 1896. Mr. M. P. Banks, township trustee of Hobart, Ind., has stated that in his township, which is a fair sample of other parts of the state, the farm land will sell readily for from fifteen to twenty-five dollars per acre more than it would have done before the movement in favor of good roads; that these good roads have had an elevating effect upon the community. The people take a pride in them, they see that they are kept up, and they, in their other affairs, "live up to them."

They are not only an evidence of prosperity, but an evidence of intelligence, and the best roads and the best school houses go together.

We are, of course, referring to "good" roads. Bad roads are the heaviest tax on the farmer.

How to Build Good Roads. The first and most important part is to protect the road from the effects of water. A wise road builder, in answer to the above question, said: "First, drainage; second, drainage; third, drainage." First provide for the drainage by open ditches or sub-surface with tile. Get the water away from the road. Give it a chance and it will run "run" away. Therefore, always give it a good crown. Remember that the wear will be much the greatest on the crown. On a 12-foot road, the center should be at least six inches higher than the sides. Eight inches is better, or 3-4 of an inch to the foot from center to side. A 36-foot road should be wet and rolled, and wet and center than at the sides.

The road bed should be smoothly graded, and well compressed with a steam roller, before the material is put on, leaving the center from six to eight inches higher than the sides. Eight or ten inches of broken stone spread in two layers over this to conform with the base, should be wet and rolled and wet and rolled (I can not repeat this too often) until it forms a compact mass.

The bottom layer should consist of

PARKS OF WILMINGTON, DEL. OUTLOOK FROM WASHINGTON STREET BRIDGE.

stone broken to a size that will pass through a 2 1-2 inch ring, and spread not to exceed 6 inches in depth. This layer should be wet sufficiently to cause it to readily bind together, but water should not penetrate to the roadbed proper.

The top layer, consisting of stone broken to pass through a ring 1 1-2 inches in diameter, to the extent of about four inches, should again be wet and rolled repeatedly. Not one road builder in ten appreciates the importance of this repeated wetting and rolling. You can not do too much of it. The future of the road depends upon the degree to which this mass has been thoroughly solidified, the different particles of stone fitted into one another, and so tightly packed that they will always remain in place.

Most roads are finished with too much screenings, which quickly grind into dust. A thin layer of screenings should be put on top of the crushed stone, sufficient to fill the voids, and then again should be wet and rolled with a ten-ton roller until the surface is perfectly hard, and perfectly smooth. It should be frequently wet, but the rolling should be continued until the roller has "squeezed" out this water, and when thoroughly dried out in this way, this road is in condition to meet the severest wear, when a metallic sound is produced by a horse's foot or a steel tire.

If this road is treated with a light coat of asphalt oil its surface will be protected from the elements. It will be dustless and its life greatly prolonged.

HISTORY OF THE SEWER, DRAINAGE AND WATER WORKS OF NEW ORLEANS, LA.

By George G. Earl, General Superintendent Sewerage and Water Board.

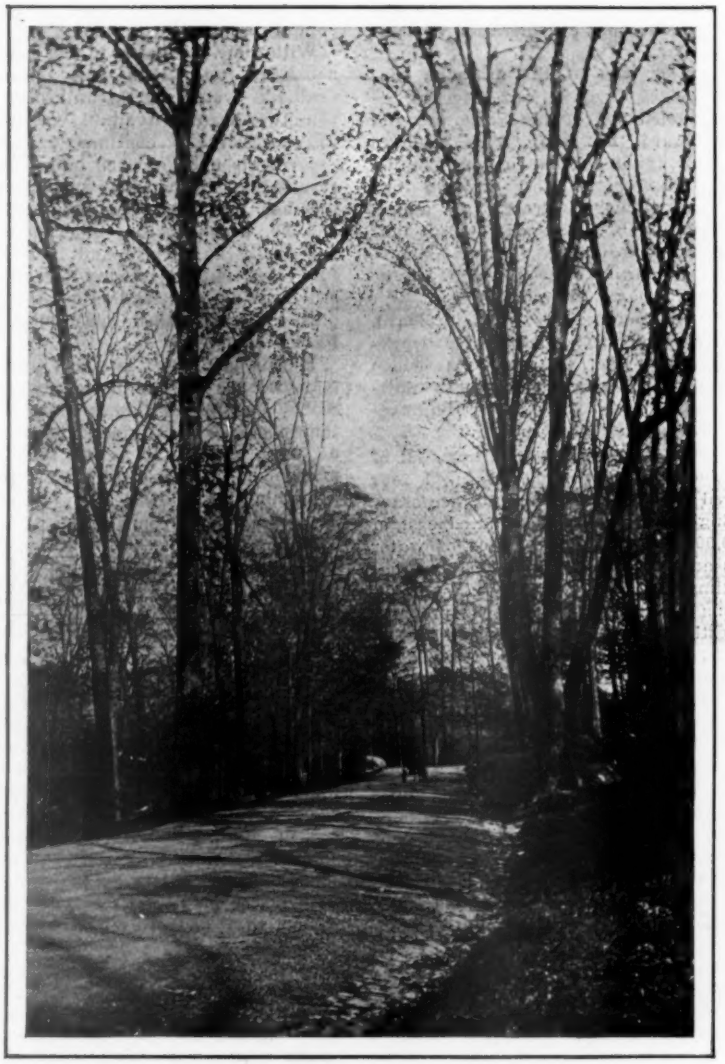
The New Orleans waterworks system, as now existing, dates back to 1836, when a private company with a franchise started its construction and gradually extended it until in 1868 it covered about sixty-five miles of streets. At this date it was purchased by the city. Private ownership had been bad, but in this case public ownership proved worse, and in 1878 the city sold to another private company, organized under a state charter, retaining this time about one-fifth interest in the property. Both transactions were largely paper transactions in depreciated securities.

The new company made considerable extensions, bonding the plant to cover their cost, and by rather high rates and the application of earnings strictly to dividends paid five to six per cent. dividends on the $2,000,000 of capital stock, besides paying interest on some $700,000 or more of bonded indebtedness. This brought the stock to par, or above, and with a franchise extending for something like thirty years, the present earning capacity and possibility for future extension and increased earning capacity outweighed the actual value of the plant, and the prospects of the waterworks company seemed very secure.

There was, however, among the people of the city, a strong feeling of dissatisfaction with both the service and the rates of the company, and a desire to recover for the city both the sewerage and the waterworks franchises which had been given out, the former not having been carried out to even such an extent as to render service, ad the latter not having been made to produce a service in any sense satisfactory. As a result, litigation looking to the forfeiture of both franchises was started.

In the case of the sewerage franchises this litigation was settled by the purchase of the constructed works at little more than the cost to duplicate them and their incorporation in the new system. No similar compromise being possible in the waterworks case it was carried through to the United States Supreme Court and resulted in the forfeiture of the company's charter on the ground that they were charging inequitable rates and rates in excess of their franchise rights. During this litigation the city had been making progress in the construction of a great drainage system, and had also framed and passed a law creating a Sewerage and Water Board and authorized a tax, which amounted to 0.004 on the assessed valuation of the city to be levied until 1942 and to be expended as interest on a $12,000,000 bond issue for and surplus to be used in the construction of a sewerage, water and drainage system.

Under this law sewerage and water for sewerage uses and for public and charitable institutions is to be free, and paying consumers on the waterworks are to be charged only such rates as are necessary to pay the cost of waterworks maintenance and operation; and it was further stipulated that not over one-third of the funds thus made available could be ex-



PARKS OF WILMINGTON, DEL. SOUTH DRIVE.

pended on drainage until sewerage and waterworks systems were completed over the entire populated area of the city.

Shortly after the creation of the Sewerage and Water Board, the operation of the drainage, and any further drainage construction, was placed wholly under their jurisdiction; so that the three works have received equal consideration at their hands.

The major part of the drainage construction done to date was executed before the existence of the Sewerage and Water Board, but they were required from their funds to take up outstanding drainage bonds and carry forward outstanding drainage contracts, all aggregating $3,900,000, and it was evident that the full one-third of the total funds permissible by the law would need to be used for drainage improvements.

The Sewerage and Water Board, therefore, undertook these three works with a limit as to resources which proved very embarrassing when the lowest possible cost of the three improvements was calculated.

The problem presented was, how, out of a $12,000,000 bond issue, to build four hundred miles of sewers and necessary pumping stations at an estimated cost of $5,300,000; four hundred miles of water mains and pumping purification plants at an estimated cost of $5,500,000; with connections to both systems to the property line, estimated to cost not less than $1,500,000; and to take up outstanding drainage bonds and contracts, aggregating $3,900,000; or a total of $16,200,000.

The solution of the problem, after careful study, was in the following form:

The fixed income of the Board approximated a four mill tax on the constantly increasing assessed valuation of taxable property. This income could be expended either as interest on outstanding bonds, or any surplus, after payment of interest, could be expended on construction. The $12,000,000 of bonds were sold to a syndicate at a price which netted the Sewerage and Water Board $12,550,000, but are only issued to them as the money is needed to carry on construction work. By fixing the rate of construction expenditures so as to complete both systems by the end of 1908, thus building part of the system out of the annual income, and arranging to make the greatest expenditures out of money from the bond issue in the latter part of such period of construction, it was shown that there would be a great saving of interest and a total sum available for expenditure on construction equal to the amount above named, and this policy was, therefore, adopted and publicly announced in 1901.

With time, however, it has been found necessary to extend and improve the drainage system to the full limit of expenditure legally available therefor, and the necessity to continue drainage improvements upon a much larger scale has resulted in legislative authorization to increase the bond issue by another $8,000,000, which further issue it is shown, can easily be carried and liquidated before 1942 out of the tax already voted, still leaving a considerable annual surplus to be expended upon extensions of the three systems.

If this last issue is voted and placed, New Orleans will obtain, as rapidly as the money can be judiciously expended, such improvements in drainage as will bring all three systems to a very high state of efficiency. The expenditures will stand something as follows:

Sewerage and connections	$6,500,000
Waterworks and connections	6,600,000
Drainage	10,900,000
Total	$24,000,000

Without the additional issue, sewer and waterworks systems, exclusive of connections to the property line, will have been completed by about the end of 1908, and the drainage will have received such expenditures as were allowed under the law, and will be in condition to handle satisfactorily anything except the very greatest of storms. Further extensions and improvements without the bond issue can only come gradually as the annually increasing surplus from the tax will pay for them. In 1909 there will be, for instance, a surplus of over $300,000, and by 1920, by most conservative calculation, this surplus should be over $600,000. In other words, it will take probably twenty years to bring the improvements which can be made in three or four years out of the $8,000,000 bond issue, if such issue should not be made.

PARKS OF WILMINGTON, DEL. CANBY MEMORIAL—FRONT VIEW.

EDITORIAL COMMENT

Engineering Projects Without Engineers.

Art in the Cement Industry.

A Puzzle in Reinforced Concrete.

ENGINEERING PROJECTS WITHOUT ENGINEERS.

In these days when nearly every one with any instinct for saving has money, there are numerous projects which appeal in all sorts of ways to those having a little money to invest. The great engineering projects which are under way under government and company management have fired the public imagination, and therefore a project which proposes striking engineering features is most likely to receive interested consideration. Lack of exact knowledge and lack of general information sufficient to enable one to distinguish between possible and impossible propositions lead some to invest in schemes which are advertised in the daily papers and by flaming circulars and booklets, when a little inquiry among those acquainted with engineering questions would show their absurdity.

There are, for example, two or three projects for electric railway lines from New York to Chicago, which apparently have for their basis a few miles of right-of-way for an interurban line or two, and for plans a straight line drawn on the map between the two cities and a picture of an electric locomotive drawing a train of cars. When, in addition to the straight line, no grade crossings and a ten-hour schedule between terminii, a promise of one to two hundred per cent. profit on stock within the near future is made, the impossibilities become so numerous that it is difficult to see why any one should be deceived. But the continuance of the advertisements shows that some money must come in, since the publishers of large daily newspapers are usually men who make reasonably sure of the cash for their advertising contracts.

Great engineering feats are performed in these days, but seven or eight hundred miles of railway on a straight line through the Allegheny mountains is not built in a day or a year, especially when it must be built on the proceeds of common stock sold at a small fraction of its face value.

Almost every city of size has one or more manufacturing propositions, founded on some one's idea of what ought to be possible, but probably is not, which is striking and can therefore be used by the professional promoter to attract the attention of the unthinking and charm the few dollars they have out of their possession on the promise of immediate and large profits, though how they can be made when nearly all the money received goes for commissions and expenses in the sale of stock is more than the confiding investor is expected to inquire into.

It is a good rule in these days of full pocket books to look with very doubtful eye on any proposition which finds it necessary to resort to large advertisements in the daily papers. The country seems to be full of money looking for good investments and the men of experience are not letting very many of the really good propositions get by them. When a scheme will not bear investigation by experts it appeals to the ignorant public through striking advertisements.

There is another class of promoters who have the same story to tell that is set out above and who have equally impossible propositions to exploit. It behooves the small investor, therefore, to make a careful investigation himself, or to invest only where he has confidence that the proposition has been properly investigated and found to be good.

The banking interests of the country have thought it advisable to begin a campaign of education against the many mining and engineering schemes without merit which are on the market, and while their self interest may lead them to class some good propositions with the bad, their warnings should be heeded.

ART IN THE CEMENT INDUSTRY.

The advantages of concrete as a material of construction were recognized so quickly in this country after the price of cement was reduced to a reasonable figure that there has been no time to consider anything but its economic features. The consequence is that most of the concrete construction is mechanic's work and bears no mark of architectural or artistic thought. Reinforced concrete is made on the principles of strength and economy and it is only as an accident that any attention is paid to its architectural

PARKS OF WILMINGTON, DEL. CANBY MEMORIAL—BACK VIEW.

possibilities. If an architect uses it he covers it up with other materials and forces it to masquerade under brick, stone or terra cotta faces. Concrete blocks are made on the principle of cheapness, and true economy and too often strength are left unconsidered. Every principle of artistic experience is violated. Consequently, the material is rejected as a symbol of cheapness by any one who wishes to make any pretensions in his building. The exceptions to these statements are so few that they only emphasize the general truth, and most of the exceptions are found outside this country, notably in Canada and Germany.

The committee on art and architecture of the National Association of Cement Users is in the hands of Mr. Charles D. Watson, of Toronto, Ont., one of the manufacturers of cement blocks who does pay attention to the artistic side of design and construction, and of Honore J. Jaxon, of Chicago, Ill., a man directly interested in the expression of artistic ideas in all sorts of workmanship. This committee expects to make an exhibit by means of photographs and lantern slides at the Chicago convention of the association, and is asking for photographs and for sketches of good work everywhere. Both the gentlemen named have sent circulars asking for the pictures and information, and Mr. Jaxon's letter contains the following:

Suggestions and information and material thus contributed will be carefully collated and properly classified for publication in bulletin form; and it is perhaps needless to enlarge upon the importance of the work thus proposed, or upon the urgent necessity that each and every one connected with or interested in any branch of the cement and concrete industry shall in a wide-awake spirit do his or her share. It is conceded that the practical merits and artistic possibilities of this most plastic of building materials give just warrant for our expecting the advent of a new and distinctive architecture which shall take its rise from the actual life of the people, and shall lend itself directly to the satisfying, in a rational manner, of present day needs and aspirations; and it is certain, and indeed obvious, that to the speedy realization of this much to be desired result the practical co-operation herewith suggested will be of incalculable value.

His address is P. O. Drawer 734, Chicago, Ill.

Continuous work by all those interested will be necessary, first, to educate the users of cement in architectural forms to the necessity of attention to the artistic requirements, and second, to show the public the possibilities of concrete construction and, as rapidly as the advancement of the trade will permit, the ability of manufacturers and contractors to furnish what they should. The efforts of this committee are deserving of commendation and their call for assistance should receive ready and general response.

A PUZZLE IN REINFORCED CONCRETE.

Several of our contemporaries have published views and descriptions of a group of reinforced concrete buildings in Tunis. It is reported that one of the end buildings settled unevenly, so that it leaned toward the central building at an angle of twenty-five degrees, and was brought back to the horizontal by weighting the higher side with some four thousand tons of sand and excavating under it to facilitate movement. The other end building settled to a similar angle, leaning from the central building, and was righted by the same process. The result was that the two buildings came to their bearings some fifteen to eighteen feet below the intended level.

These statements are rather large, and part of the puzzle is to reconcile them all with each other, the above being the straigntest story which could be selected. But the real puzzle is to reconcile the picture of the buildings at various stages of the story.

There are three of these pictures, and the end buildings seem to have little in common except that each has five floors. Even the three corners of the central building differ materially in their architectural features, so that the observer is quite at a loss to know whether he is the victim of some trick photography or of a combination of photographs of various buildings to fit the story. He may wonder whether the photographs have been retouched out of recognition. To complicate matters some of the statements in the story are corroborated by the photographs and some of them are not.

Taken together, it seems advisable to suspend judgment on the story until a more scientific and authentic account is received. Apparently the original of the story comes from Chicago.

THE QUESTION DEPARTMENT

SEPTIC TANK FOR CHAUTAUQUA GROUNDS.

I would like some information regarding plans for septic tank for sanitary purposes on the grounds of a summer Chautauqua. E. L. H., ——, Kan.

If the grounds are supplied with running water so that their refuse aside from garbage and combustible material can be carried away by means of the water, the septic tank can be used very successfully for purifying the sewage thus created. The septic tank alone will not purify the sewage enough to make it into drinking water, but under what may be termed average conditions will purify it enough for all practical purposes. The writer constructed such a tank some fifteen years ago for a summer population of two or three thousand, and it has been in successful operation ever since and has given rise to no complaint on account of the discharge of its effluent into the small stream below it.

Several articles on this subject have been published in MUNICIPAL ENGINEERING, giving discussions of general principles and descriptions of tanks in actual use. A long list of these articles was published in the October number, vol. xxxi, p. 281.

BUILDERS OF CONCRETE BRIDGES.

Will you please give me the names of some contractors of concrete bridges.
J. G., Portland, Ind.

Reference should be made for names of competent contractors building concrete bridges to the "Business Directory" printed in each number of MUNICIPAL ENGINEERING under the headings, "Bridges," "Concrete Steel Arch Bridges," some of those under "Concrete Work," and "Contractors," "Expanded Metal Construction," "Foundations, Concrete," "Reinforced Concrete Construction."

DEALERS IN CONCRETE SAND.

Would you kindly bring me in communication with dealers in sand used in cement work? I. F. G., Allentown, Pa.

Most localities have sand of more or less value near at hand for use in concrete work. If sand must be shipped in the cost of the work is materially increased.

Following are names of some dealers in sand within reasonable reach of Allentown: Wm. Brooks Son Co., 615 W. Fourth street, Brown & Fleming Contracting Co., 129 Broad street, Goodwin Bros., 17 Battery Place, New York City; William Wirt Clarke & Sons, 115 S. Gay street, Baltimore, Md.; Connellsville White Sand Co., and C. D. Yowler, Connellsville, Pa.; Detwiler Sand Co., York, Pa.; Hatfield & Phillips, Alexandria, Pa.; Peoples Bros., 2508 Callowhill street, and Quaker City Mortar Co., 50 N. Twenty-third street, Philadelphia, Pa.; Shoemaker, Reed & Co., Greensburg, Pa.; Valley Hill Sand Co., Malvern, Pa.

DEALERS IN STONE, SAND AND MOSAIC.

We would like the names of firms who could supply us with the following:
1. Marble for floor mosaic.
2. Crushed granite for sidewalk and block paving.
3. White silica sand.
P. & B., Rising Sun, O.

1. Mosaic cube importers are C. D. Jackson & Co., Manhattan Marble Co., Chas. J. Roussel, 524 W. Fiftieth street, New York. The latter has a marble mosaic cutting machine. Other dealers in mosaic marbles are Samuel H. French & Co., Fourth and Callowhill streets, Philadelphia, Pa.; Cassini Mosaic and Tile Co., 10 E. Seventh street, Great Western Marble Works, 1602 Reading road, and Schoone Mosaic Co., Cincinnati, O.; Geo. E. Heidenreich, 268 Erie street, Norcross Co., 269 River street, Talamini Mosaic and Marble Co., Builders' Exchange, Vincent-Barstow Co., 725 Euclid avenue, and Chester J. Wadsworth, 5806 Euclid avenue, Cleveland, O.; Chas. Wege Marble and Tile Co., 375 W. Rich street, Columbus, O.

2. The following are names of dealers in crushed granite nearest Ohio: Amberg Granite Co., 438 Fulton street, American Crushed Stone Co., 92 La Salle street, Dolese & Shepherd Co., 184 La Salle street, Milwaukee Monument Co., Chamber of Commerce, Western Granite Supply Co., Chamber of Commerce, Wisconsin Granite Co., 138 Washington street,

Chicago, Ill.; Kizer Coal Co., Decatur, Ill.; P. M. Bruner Granitoid Co., 904 Olive street, J. C. Finck Mineral Milling Co., 101 Barton street, Milne & Gordon, Jefferson and Missouri Pacific railroad, Geo. Pickel Granite Crushing Co., 2015 Gratiot street, Schneider Granite Co., Fullerton Building, Phil F. Stifel, 2324 Kosciusko street, Twentieth Century Granite Co., 421 Olive st., St. Louis Mo. Names of others will be found in Hendricks' "Commercial Register of the United States" ($10). The St. Louis Crushed Quartz Co., 303 Roe Building, St. Louis, Mo., should be considered in this connection.

3. Following are names of producers of silica sand nearest our correspondent: Philadelphia Silica Sand Co., 1505 Race street, Philadelphia, Pa.; Temple Sand Co., Reading, Pa.; Valley Hill Sand Co., Malvern, Pa.; U. S. Silica Co., The Rookery, Chicago, and Ottawa, Ill.; Garden City Sand Co., Security Building, Chicago, Ill.; Pennsylvania Glass Sand Co., 341 Fourth avenue, Pittsburg, Pa.

COMPARATIVE MERITS OF PORTLAND CEMENTS.

Can you inform me as to how "Kosmos Portland cement," of Louisville, Ky., and "Atlas Portland cement" compare in quality. A. R. L., DeKoven, Ky.

The Pennsylvania Atlas cement is made of cement rock or cement rock and limestone. The Missouri Atlas cement is made of limestone and clay. Kosmos cement is also made of limestone and clay. They are all made by the same dry process and burned in rotary kilns, and should be quite similar in quality. This information is taken from the "Directory of American Cement Industries" ($5). Can any one of our readers who have used both cements give their experience with them?

HANDBOOK FOR CEMENT USERS.

Will you kindly tell me if there is any ingredient to mix with the top finish coat for Portland cement flooring that makes it impervious to water or the urine from horses. The Standard Oil Company is building large stables for horses on overhead floors, and one of their men asked me the question yesterday, and said he saw an article to that effect somewhere. I will be obliged if you can tell me whether there is or not, and how to find out all about it. Is there any work that tells how and what to use for same? Also, how to color cement any color desired. In fact, a book of instructions for all kinds of cement work, and where I can get it. C. W., Oswego, N. Y.

The "Handbook for Cement Users" ($3) gives all the information desired. The finish usually put on sidewalks and floors makes the concrete waterproof, but the joints in the floor must also be thoroughly waterproofed with tar paper and asphalt. The liquids named will not seriously affect the concrete if the floor is kept clean and is frequently washed off with plenty of water. Wooden slat floors or platforms will be needed for horses to stand on, and tney should be removable and be set above the floor enough so that the floor can be washed with hose without entirely removing the platforms if desired.

CITY ENGINEER'S OFFICE RECORDS.

I would thank you for references to articles on office records for a city engineer's office.

C. A. P., Memphis, Tenn.

Johnson's "Surveying" ($4) Staley's Gillespie's "Higher Surveying" ($3), and McCullough's "Engineering Work in Small Cities and Towns" ($3), contain some good material on this subject. The following articles in MUNICIPAL ENGINEERING will be found valuable:

In vol. xxxii: "A Method of Filing Notes, Sketches and Clippings," by James C. Bennett, p. 41.

In vol. xxx: "Filing and Indexing City Engineers' Records," p. 270; "Loose Leaf System for Field Notes and Office Records," p. 409.

In vol. xxix: "Establishing Grades and Monuments in Small Towns," by Ralph B. Slippy, p. 432.

SUFFICIENCY OF PLANS FOR ARCH.

I herewith send you print of a plan for a stone arch bridge to be built of native sandstone. I would like your criticism of plan and suggestions for betterment. Also point out errors in showing probable intent of plan in drawing.

OKLAHOMA SUBSCRIBER,
Guthrie, Okla.

A blue print of a plan for an arch accompanied the above letter. The arch is semi-circular, of 16 feet span, 2 feet depth of keystone, 2½ feet width of abutment at springing line, about 5 feet fill of earth above crown to roadway, wing walls at about 45 degrees angle and 2 feet thick, tied tigether with wire to prevent spreading. Waterway is paved under arch with end walls of concrete. Foundation of abutments and wing walls is 12 inches of concrete. Specifications and estimate are written in the spaces between drawings.

The general criticism of the arch is that the dimensions are either too small or very close to the limit, and wing walls solid enough to stand alone will be much more satisfactory and far more durable

than the light walls tied together with wire cable. The wing walls are but 10 feet long, and unless they run into a bank capable of standing at a very steep angle are too short, being much too short for an earth fill, which would apparently be about twenty feet in height. Whether the sandstone to be used is capable of standing the pressure which would be developed, what is the amount of water at flood times, what is the character of the bottom and consequent necessity of more paving, there are no data to determine. The recommendation is that the problem be submitted to an engineer with experience in this class of design and construction who can visit the site and make a plan to fit it and to carry the loads certain to cross the bridge.

NEED FOR ELECTRIC WIRE FACTORIES.

We are seriously considering the manufacture of electrical wire, cordage and cables, consisting of plain, covered and insulated. It would be our intention to go into this business on a fairly large scale, and manufacture only the highest possible grade of material, and not to disturb the market in any way, but to sell at a fair ratio of profit. We would very much appreciate your frank advice in relation to the matter—whether or not it is a profitable business, and if you consider there is plenty of room for other manufacturers.

If you would put us in touch with either manufacturers who desire such a plant or with a thoroughly competent foreman, superintendent or engineer who could construct and operate such a plant, and, in fact, such information as you may be able to obtain relative to the cost of machinery for producing same, the manufacture of such machinery, the cost of manufacture, selling price, etc., we would very much appreciate it. We would like this information to embrace the entire field. W. R. P., ———, N. Y.

This is too large a question for one person to answer, and it is referred to our readers. The competent engineer asked for will be referred to our correspondent if he will forward his name and address to MUNICIPAL ENGINEERING.

ARTICLES ON ELECTROLYSIS.

Kindly let me know in what numbers of your journal are to be found articles on electrolysis, and oblige, yours truly,

E. G. BARROW, City Engineer,
Hamilton, Ont.

The following articles in MUNICIPAL ENGINEERING have valuable information on electrolysis and methods of preventing electrolysis of pipes:

In vol. xxix: "Cement Joints for Gas Pipes," p. 21.

In vol. xxvi: "Some Examples of Electrolysis of Pipes," p. 331; "Electrolysis Not a Necessity," by A. Ross Gray, p. 232; "Electrolysis in Richmond, Va.," p. 127.

In vol. xxiv: "Electrolysis Suit Entered by St. Paul," and "Ordinance to Prevent Electrolysis," p. 53.

In vol. xxiii: "Electrolysis Discussed at Central States Water Works Association," p. 269; "Unusual Case of Electrolysis at Norfolk, Va.," p. 290; "Improved Electrical Conditions," p. 349; "Preventing Electrolysis of Underground Gas and Water Pipes," p. 467; "Electrolysis in Bay City," p. 190.

In vol. xxii: "Milwaukee Electric Railway Held Responsible for Electrolysis," p. 105; "Damage by Electrolysis," p. 245; "The Dayton Electrolysis Case," p. 299; "Electrolysis Case in St. Paul," p. 317; "Dayton's Electrolysis Case Decided," p. 322.

In vol. xxi: "Electrolysis of Water Mains in Dayton, O.," p. 38; "Damage from Electrolysis in St. Louis," p. 101; "Effect of Electrolysis on Insurance Rates," p. 146; "Edison-Brown Bond," p. 153; "Norfolk, Va., Ordinance on Electrolysis," p. 250; "Report of City Engineer of Rochester, N. Y., on Electrolysis," p. 354; "Electrolysis in Several Cities," p. 419; "Decision in Electrolysis Case in Peoria," p. 34; "Electrolysis of Water Main in Racine," p. 36.

In vol. xx: "Electrolysis of Water and Gas Pipes," by W. W. Brigden," p. 287; "Decision on Electrolysis Case in Indianapolis," p. 47; "Electrolysis of Water and Gas Pipes," p. 287; "Electrolysis in Hartford and Brooklyn," p. 300; "Prevention of Electrolysis," p. 348.

In vol. xix: "Court Decisions on Electrolysis, p. 26; "Demand for Damages from Electrolysis," p. 49; "Some facts and Figures Regarding Electrolysis," p. 74; "Attitude of Courts on Electrolysis," p. 215; "Investigation of Electrolysis in Providence," p. 231; "Electrolysis in Seattle to be Investigated,' p. 359.

In vol. xviii: "Electrolysis in Newark, N. J.," p. 406; "Electrolysis in Natural Gas Belt," p. 38; "Prevention of Electrolysis," p. 1; "Law to Prevent Electrolysis in Chicago," p. 51; "A Gas Committee on Electrolysis," p. 403.

In vol. xvii: "Electrolysis from the Standpoint of the Municipal Electrician," by H. S. Wynkoop, p. 270; "Electrolysis in American Cities," by F. A. W. Davis, p. 349; " Plan for Preventing Electrolysis," p. 39; " Prevention of Electrolysis," p. 92; "Investigation of Electrolysis at Yonkers, N. Y.," p. 102; "Interesting Case Involving Electrolysis," p. 217; "Electrolysis in New York," p. 309; "Investigation of Electrolysis at Muncie," p. 309; "Gas

Pipes Damaged by Electrolysis," p. 371.

In vol. xvi: "Electrolysis of Cast Iron Water Pipes at Dayton, O.," by H. P. Brown, p. 84; "City Sues for Damages from Electrolysis," p. 264; "An Instance of Damage from Electrolysis," p. 329; "Electrolysis at Logansport," p. 401; "Who is Liable for Electrolysis of Pipes," p. 36.

In vol. xv: "Ravages of Electrolysis in Dayton, O.," p. 251; "Electrolysis in Logansport," p. 353.

In vol. xiv: "Electrolysis in Washington, D. C.," p. 157; "A Remedy for Electrolysis," p. 286.

In vol. xiii: "Electrolysis in Chicago, Ill.," p. 238; "To Prevent Electrolysis," p. 374.

In vol. xi: "Electrolysis of Water Pipes," p. 172; "Electrolysis Suit of Omaha Water Works Company," p. 189; "Destruction of Water Pipes by Electrolysis," p. 310; "Prevention of Electrolysis," p. 31.

In vol. viii: "How to Prevent Electrolysis of Gas and Water Pipes," p. 178.

In vol. vii: "Destruction of Underground Pipes by Electric Currents," p. 133.

WATER RATES IN ILLINOIS CITIES.

Has your office statistics relative to the rates paid in various cities to water companies for the use of water? We are about to renew the franchise with our water company and the question of readjustment of the water rates has come up. The feeling prevails here that the rates we have been paying are excessive and we want to compare the rates paid in this city with what is paid by other cities. We would also like to know how the rates differ when the water plant is owned by the city and when owned by private corporation. If you can refer me to any place where I can get this information I will appreciate it very much.

J. D., ——, Ill.

The "Manual of American Waterworks" ($3) gives a tabular statement of the water rates in many cities in the United States. It is not possible to reduce all the rates accurately to tabular form and so the following comparison of rates may not be exact, but it is approximately correct. Some changes may have been made also since the date of the list, 1897. The comparison will be made between the city in which our correspondent lives and other Illinois cities.

The family rate in that city is $8 a year. Waterworks in Illinois under public ownership have rates varying from $3.25 to $9, and those under private ownership from $6.50 to $10.

The water closet rate is $2.50 in that city, and ranges from $1.50 to $6 in public ownership plants, and from $2.50 to $5 in private ownership plants.

Bath tub rate is $4.50 in that city, $ 0 to $4 in public ownership plants, and $3 to $8 in private ownership plants.

Wash bowl rate is 0 in that city, $0 to $3 in public ownership plants reporting such a rate and $0 to $3 in private ownership plants so reporting.

Horse and carriage rate in that city is $3, $0.75 to $5 in public ownership plants and $2 to $8 in private ownership plants.

Hose rate is $5 in that city, $0 to $7 in public ownership plants and $2 to $25 in private ownership plants.

Meter rates in that city are from $0.35 per 1,000 for 100 gallons a day to $0.15 per 1,000 for over 5,000 gallons a day. In public plants, the maximum price runs from $0.10 for less than 165,000 to $0.50 a thousand for 300 gallons a day and in private plants it runs from $0.20 for less than 100 gallons to $0.50 a thousand for 100 gallons a day. The minimum price in public plants runs from $0.05 to $0.35 a thousand for more than 2,000 gallons a day, and in private plants from $0.08 to $0.45 a thousand for more than 1,000 gallons a day.

From the face of this statement it would seem that the family rate, probably made up from several charges to what the average family requires aside from the special rates named in the succeeding paragraphs, is high and that the hose and horse and carriage rates are somewhat above the average, but that the other rates are low. The family rate is the principal rate, however.

Definite conclusions cannot be drawn, however, from the letter of such statements. There may be conditions in this city which make the expense of supplying water greater than usual and in such case the rates must necessarily be higher. A new schedule of rates should only be adopted after full study of the local conditions. It is common for water companies to agree to furnish water at prices not to exceed those charged in neighboring cities and thus to perpetuate the high rates which were doubtless necessary when the works were new. It is much better to find out as nearly as possible the actual cost of the service and then to make liberal additions for interest on investment, deterioration and sinking fund, and to base the rates on the total thus obtained.

It will be noted that the rates under public ownership quoted above are lower than those under private ownership. This results from several causes. There is a strong tendency in such plants to fix the rates near the cost of the service and it is often strong enough to fix them below actual cost when proper allowance is made

for interest, depreciation, renewal, etc. These charges when they accrue, must be met by borrowing more money on the credit of the city and repaying it from the treasury of the city. While the city should pay its share of the cost of construction and operation of works, it should not be called upon to pay more than its share and rates should not be put so low that this is the result.

In comparing rates under public and private ownership, therefore, the important items mentioned, and others like them, must not be forgotten. It is probably true that, even with these items properly taken care of the rates in private plants are the higher. If they are they are too high, and should be lowered to the point where the capital invested will receive ample return and security, but not more. High rates were necessary in new plants and the city often paid more than its share, but conditions have changed and when new contracts are made the rates for private and public service should be fixed to meet the changed conditions.

The investigation should really be made by an expert in waterworks cost and in fixing rates.

MACHINES FOR DIGGING TRENCHES FOR WATERWORKS.

Will you kindly let me know what you consider the best publication upon constructing water systems, and excavating through rock as well as soft ground. My enquiry is more particularly to get to know of the best tools and machines for trench excavations, as I am pretty well posted in constructing water and sewerage systems by hand work, but have tendered for a water system, based upon all manual labor, and wish to learn whether or not it would pay to purchase machines for the work

A., ——, N. B.

There is no book upon trench machines and very little in any book upon the subject. Prelini's "Earth and Rock Excavation, ($3), contains descriptions of the Austin trench excavating machine, the Moore trenching machine and the Carson trenching machine. Gillette's "Handbook of Cost Data" ($4), gives data regarding cost of excavating trenches in rock and earth by hand and with the Carson machine and the Carson-Lidgerwood cableway of the Carson Trench Machine Co., Boston, Mass., the Chicago trench excavator of the Municipal Engineering and Contracting Co., Chicago, Ill., the Potter machine of the Potter Mfg. Co., Indianapolis, and the Adams and Moore machines. McCullough's "Engineerng Work in Towns and Small Cities," ($3) contains a description of the Chicago machine.

Most of these machines are most economical on trenches of the depth usual for sewers, but they can all be used to some advantage on water trenches in earth and there are one or two machines, such as the Austin, which are intended especially for water trenches.

SINKING WELLS—FORM OF PUMPING STATION RECORDS.

Please send me information in regard to book, back numbers, or anything you have in regard to sinking open and driven wells for city waterworks; also samples of waterworks engineers' log book for keeping pumping station records.

W. R. T., ——, Norton, Kan.

Turneaure and Russell's "Public Water Supplies," ($5) seems to have the best chapter on well sinking to be found in any text book.

The simplest log book for keeping pumping station records has the following headings to columns:

For the pump record: Date, Hour, Counter, Gallons each reading, Gallons per Day, Remarks.

For the pressure record: Date, Hour, Steam Pressure, Water Pressure, Vacuum, Remarks.

For the boiler record: Date, Hour, No. of Boiler, Weight of Coal, Weight of Ash, Weight of Feed Water, Steam Pressure, Remarks. If specially detailed records are desired, there may be columns also for the temperature of water in pump well, temperature of feed water, calorimeter.

HOW TO INSTAL WATER, LIGHT AND SEWERS IN SUBURBAN PLAT.

I want to install sewerage, water and lights in a property covering about 100 acres. The land is nearly level and no part is more than one-fourth of a mile from river. The lowest part is about two feet above high water, the highest about eight. Water supply would be from driven wells forty feet deep and rises within three feet of surface. Any instructions you could give me as to best method would be appreciated. At no time would there be more than three hundred houses to supply. Within the next year there would not be more than twenty.

A. C. H., Washington, D. C.

The first step to take, if the best and most economical system is desired, is the employment of a competent civil engineer to study the problem on the ground and make the plans. He can advise as to the next steps. A land surveyor has probably not had sufficient experience with the public utilities named to give the best service. Names of good men may be found in the "Business Directory," published

in each number of MUNICIPAL ENGINEERING under the headings, "Civil Engineers" and "Consulting Engineers," selecting those making specialties of the subjects named and those in the vicinity of Washington.

BOOKS ON THE LAWS REGULATING SURVEYS.

Can you give me the names of any books treating of the laws and decisions relating to property lines in cities, and legal information that would be desirable for a city surveyor to know?

J. B. M., Oakland, Cal.

Hodgman's "Manual of Land Surveying," ($2.50) will probably give some instruction, although it is intended more particularly for land surveyors outside of cities and for districts in which the U. S. rectangular system has been used. Johnson's "Surveying," ($4) has a good chapter on city surveying and an appendix on the judicial functions of surveyors which should be of much value. The statutes of California must of course be followed, and the court decisions in that state will aid the surveyor in performing his judicial functions.

WATER FOR CONCRETE—ESTABLISHING STREET GRADES.

Will you please let me know where I can find information in regard to amount of water required for mixing Portland cement concrete in proportions 1:4:7 for street paving?

Please give sources of information on establishing grades for city streets and treatises on street design in general. I have Baker, Tillson and Spalding, but none of these treat the subject exhaustively. I have read your magazine for some time and find same a very valuable aid in my work.

E. B. C., Columbia, Mo.

1. The question of the amount of water to be used in mixing concrete is one which cannot be answered definitely. The amount of moisture in the ingredients, the brand of cement, the condition of the atmosphere, the rate of evaporation, affect the amount of water to be used. There is much difference of opinion as to the consistency of the concrete which will give the best results. The amount of mixing and of ramming also has considerable effect upon the condition of the completed concrete. There have been experiments on the strength of mortars and concretes mixed with varying amounts of water and the general results indicate an improvement in strength with increase in amount of water within reasonable limits.

In a series of experiments by Geo. W. Rafter, he made dry 3 to 1 mortar by adding from 18.3 to 21.3 pounds of water per cubic foot of mortar, the amounts varying for the five kinds of cement used. Plastic mortar was made with 20 to 21.6 pounds of water and excess mortar, so-called, with 22 to 23.2 pounds of water. The dry mortar was a little more moist than damp earth and required much ramming to flush water to the surface. The plastic mortar was ordinary mason's mortar and required a moderate amount of ramming. The excess mortar quaked under moderate ramming. These experiments showed the dry mortar blocks to be the strongest, plastic next and excess next. Other experiments under other conditions show wet mortars to be the strongest after some months curing. There is a difference in judgment as to excess of water, what Mr. Rafter calls excess mortar being somewhat dry as compared with the wet mortar and concrete used in reinforced concrete construction, for example.

For street foundations the concrete should be wet enough to make a dense concrete when reasonably well tamped. If rather dry, the concrete is easier to handle and takes more space, but will probably not be tamped enough to make a dense concrete. If too wet, the water drains out and moistens the subgrade and the cement is separated from the mixture, both objectionable features. In a discussion of Mr. Rafter's results, Mr. Geo. W. Tillson says that in street foundations "a dry concrete will give good results in cool weather, but will be of practically no value in warm weather." In that the upper part of a dry concrete layer does not retain enough water to set properly. The amount to be used must be determined by trial with materials in normal condition and must then be varied as the conditions of weather and of materials require. The concrete should be sprinkled in dry weather as frequently as the rate of evaporation requires. Roughly, the weight of water in the mixture named in the question may be from one-third to one-half the weight of the cement, according to various authorities, but they all recommend variations from the stated proportions to make the concrete suitable for the existing conditions.

2. Baker's "Roads and Pavements," ($5) contains as good a discussion of the subject of establishing street grades as any book in print. Byrne's "Highway Construction," ($5) also has a good chapter on the subject which differs slightly in the detail of the matters treated.

Articles in MUNICIPAL ENGINEERING give the fullest treatment of all parts of the subject available. Following are the most important which have appeared:

"Steepest Grade for Asphalt Pavement," vol. ix, p. 305.

"Cross Section on a Hill Side Street," vol. xii, p. 168.

"Cross Sections, Crowns and Foundations of Streets wtih Various Grades," three articles, vol. xiv, pp. 206 and 209.

"Street Grades," by C. P. Chase, vol. xvi, p. 357.

"Street Grades and Cross Sections in Asphalt and Cement," by R. P. Woods, Jr., vol. xvii, p. 190.

"Formula for Street Grades," vol. xviii, pp. 36 and 109, in which the multiplication sign should be changed to a plus sign.

"How Street Intersections Should be Planned," vol. xviii, p. 167.

"Staking Grade for Streets," vol. xxiii, p. 28.

"Steepest Allowable Grade on Viaduct," vol. xxiv, p. 362.

"Form of Ordinance Establishing Street Grades," vol. xxvi, p. 430.

"Designing Street Intersections," by J. H. Davis, vol. xxviii, p. 213.

"Establishing Grades and Monuments in Small Towns," by R. B. Slippy, vol. xxix, p. 432.

"Cross Section of Side-Hill Street," vol. xxix, p. 351.

"Concrete for Steep Streets," vol. xxx, p. 202.

"Street Plan with Converging Curb Lines," vol. xxxi, p. 395.

CONCRETE

Finishing Concrete Surfaces—Architectural Form and Finish—Finishing Concrete Walls—Reinforced Concrete Ordinance in San Francisco—Concrete and Sand Lime Brick—Fire Tests of Sand-Lime and Clay Brick—Largest Concrete Wall—Concrete Construction Ordinance in Pittsfield.

Methods of Finishing Concrete Surfaces.

Probably the best example of concrete house construction on this side of the Atlantic is the home of Mr. Alfred Mitchell, near Port Antonio, Jamaica, built by the Aberthaw Construction Co. from the plans of Mr. Horace S. Frazer. Its walls are masses of reinforced concrete, which have shown no shrinkage, although some are quite long, 73 feet in one case and 90 feet in another. The attractive appearance of the house is due in a measure to the skillful manner in which the surface finish brought out the special qualities of the light yellow coral rock and coral sand used in the concrete. Mingled with the coral was a little clayey earth of a brilliant crimson color. A little lime was used in the mortar to make it whiter and in conjunction with the earth produced a wall having a warm flesh tint. After the dull surface and board marks were removed by chipping with pneumatic tools or by washing with dilute acid, the resulting face was remarkably handsome.

Another piece of work which has attracted wide attention for the excellent appearance of its surface is the reinforced Boulevard Bridge built under the direction of Mr. George S. Webster over the North Penn R. R. at Philadelphia. In this structure the face is a mixture of one part cement, two parts sand and three parts granolithic grit, placed against the face of the form in a nominal thickness of one inch just ahead of the body concrete. While the concrete was still fresh the face planks of the forms were taken off and the surface washed with an ordinary house scrubbing brush with water flowing over it from a sponge or hose. This removed the dull cement film and exposed the grain of the material. The purpose of these comments is to point out that plain surfaces of concrete can be given a satisfactory finish for most classes of structures, architectural as well as engineering. It is natural, in view of the present lack of general knowledge of the methods of securing good results, that there should be considerable hesitation in relying upon a concrete surface for many places, but as experience with good work is gained the advantages of treating the

concrete so as to avoid the necessity of hiding it behind a plaster, a stucco or a veneer, will be self-evident to everybody. —*Engineering Record.*

Architectural Form and Finish in Concrete Construction.*

BY WILLIAM L. PRICE.

I turn to the possibilities of the material architecturally. I cannot see much sense in the use of concrete as a substitute for block building material, although it will probably have its place if it is frankly treated as concrete and not as imitation stone. But the possibilities of design in concrete used this way are those of its competing materials, stone, brick and terra cotta, so that I shall not dwell upon that, but try to point out something of what seems to me to be its greater possibility as a plastic material.

In block building, whether of stone, brick or other material, the joints are an essential element of building, and as such should become an essential element of design to be accentuated rather than hidden, and in all characteristics and good architectural design you will find recognition of this fact. Take, for instance, any of the classic orders or their modifications in the Renaissance, and you will find a frank succession of blocks and columns set upon plinths, or directly on basement wall, cap, abacus, frieze and cornice, all built up stone upon stone with major joints marked by moldings, bands and ornament, a logical, built structure. But if we attempt to follow such a system of design in a plastic material, or even a material like wood, the results are disastrous to true architecture. The design becomes a matter of external form, not of the true expression of methods and materials used. Concrete is built with shovel and trowel, and its proper ornamentation should be either cast in molds as built or such as can be run or fashioned on the work, with the addition of such color ornament as may be obtained by the use of terra cotta or other protecting material used as wall copings, roofs, pier caps, etc., and such other flat color ornamentation as may be produced by the use of tiles, marble, glass or other material which is evidently applied to the surface. It is evident that this would and should make a wide departure from classic forms and accepted styles, that it means in fact a new architecture, although it will not be necessary to abandon all precedent. We shall want walls, windows and doors in any case, and must learn to build them in their accepted forms. But in a material so plastic the forms of openings and moldings may be expected to vary much from those necessary to an architecture dependent on arches and lintels. There is more to be learned in the Spanish, or Californian and Mexican varieties of Spanish, than any other accepted type. Their plastered walls, tile roofs and wall copings suggest concrete more than they do brick, and their domes and curved pediments are already suggestive of plastic rather than block construction.

I may perhaps be permitted to refer to the Blenheim Hotel as an example of an attempt to carry out some of these thoughts. At least there is no suggestion of built structure in its simple wall openings, its exceedingly few and simple moldings, and its total lack of cornices. We have distinctly tried in it to use a solid wall, pierced by the simplest openings, in an effort to reduce to a minimum the chopped-up appearance common with buildings that of necessity have many windows and small unbroken wall spaces. We have attempted, even where the wall was broken still further by bay windows, to preserve this feel of wall and have used the shadows thrown upon this broken surface by balconies, to give the relief usually obtained by ornamented cornices, and with the addition of a tile roof and some beautiful color obtained with Mercer tile, we have secured sufficient color and variety to make a building essentially plain in wall surface give a sense of richness not always obtained by the use of elaborate and expensive ornamental work in stone or terra cotta, and the use of a moderate amount of terra cotta where required for sills, copings, and other wall protection, has been made unusually important by modeling it in interesting and appropriate sea forms and coloring it a light green, by a glaze which has the additional advantage of destroying any semblance of stone and giving it a plastic character that seems appropriate to modeled ornament. It is along the line of simple and direct expression of the purpose and mode of construction of building that architecture grows when it is really growing, and cement in its manifold possibilities spreads before us a new field for the imaginative designer.

*From a paper before the Association of American Portland Cement Manufacturers.

Finishing Outer Surface of Concrete Walls.

A rather novel method of finishing the outer surface of the walls of a reinforced concrete building was recently adopted in

connection with a structure in Knoxville, Tenn. The sides of the building have curtain walls of concrete brick, while the front and back walls are monolithic construction. When the work was completed the front elevation was treated to a cement solution applied by means of whitewash brushes. The solution consisted of water and cement of the consistency of thin grout, which was strained through cloth to remove any coarse particles that might scratch the concrete surface of the building. The coated surface was given a light and quick rubbing with carborundum bricks until a very smooth surface was obtained. The thickness of the solution prevented it running off the wall and served as a plaster as well as a dressing. The result is a front of one color which closely resembles limestone.

A reinforced concrete bridge in Knoxville had its outer surfaces treated in the same way with very satisfactory result. The cost of the wash and rubbing is stated to have been about ten cents a square yard of plain surface. Where there are indentations or projections of any sort the cost is increased and with any elaborate attempts at ornamentation even with all plane surfaces, but not all one surface, the cost may run to forty or fifty cents a square yard.

Ordinance to Regulate Concrete Building Construction in San Francisco.

Reinforced concrete frame buildings of Class B may be constructed with a frame of columns, girders, beams, walls and floors of reinforced concrete.

All reinforced concrete shall be constructed in accordance with the following provisions:

The term "reinforced concrete," as used in this ordinance, shall be understood to mean an approved concrete mixture reinforced by steel of any shape, so combined that the steel will take up the tensional strain and assist in the resistance to shear.

Stress. Reinforced concrete construction shall be of such nature that the stresses can be calculated according to the accepted formulas of modern concrete engineering practice.

Concrete—Mixing of; method of testing. The concrete shall be mixed in the proportions of not less than one of cement to six of aggregates, consisting of sand and gravel or broken stone of 1 in. major dimensions. The proportions shall be such that the resistance of the concrete to crushing shall not be less than 2,000 lbs. per sq. in. after hardening for 28 days. The tests to determine this value shall be made by a competent engineer under the direction of the Board of Public Works. The concrete used in reinforced concrete construction shall be what is usually known as a wet mixture.

Steel. All steel with an elastic limit exceeding 40,000 lbs. shall have a mechanical bond with the concrete.

Reinforcing—Method of. All reinforcing steel shall be completely enclosed by the concrete, and such steel shall be nowhere nearer to the surface than 1½ times the diameter of such reinforcing steel bar or rod or other shape, but never less than 1 in. The steel in beams or girders shall be so disposed that there shall be not less than 1½ times the thickness of the steel in concrete between the steel, and where the number of bars used cannot be placed in one plane they shall be placed in two or more planes.

Reinforced concrete shall be so designed that the stresses in concrete and the steel shall not exceed the following limits: Extreme fiber stress on concrete in compression, 500 lbs. per sq. in.; shearing stress in concrete, 75 lbs. per sq. in.; concrete in direct compression, 450 lbs. per sq. in.; concrete in spirally wound columns, 700 lbs. per sq. in.; tensile stress in steel, one-third of the elastic limit; shearing stress in steel, 10,000 lbs. per sq. in.

The adhesion of concrete to steel shall be assumed to be 75 lbs. per sq. in. of surface where bars are ¾ in. or less in diameter, and proportionately less in bars of a diameter greater than ¾ in.

The ratio of the moduli of elasticity of concrete and steel shall be taken as 1 to 15.

The following assumption shall guide in the determination of the bending moments due to external forces: Beams and girders shall be considered as simply supported at the end, no allowance being made for continuous construction over supports. Floor plates, when constructed continuous and when provided with reinforcement at the top of plate over the supports, may be treated as continuous beams, the bending moment for uniformly distributed loads being taken as not less than W L divided by 12; the bending moment may be taken at W L divided by 20 in the case of square floor plates which are reinforced in both directions and supported on all sides. The floor plate to the extent of not more than five times its depth may be taken as part of that beam or girder in computing its moment of resistance, and the beam and slab must be built at the same time as a unit.

W equals the total load.

L equals the distance between centers of support.

The moment of resistance of any reinforced concrete construction under transverse loads shall be determined by formulas based on the following assumptions:

(a) The bond between the concrete and steel is sufficient to make the two materials act together as a homogeneous solid.

(b) The strain in any fiber is directly proportionate to the distance of that fiber from the neutral axis.

(c) The modulus of elasticity of the concrete remains constant within the limits of the working stresses fixed in this ordinance.

The dimensions of such a beam or girder and its reinforcement shall be determined and fixed in such a way that the strength of the metal in tension shall measure the strength of the beam or girder. If the concrete in compression, including the allowable concrete in adjoining floor construction, does not afford sufficient strength for that purpose, the compression side of the beam or girder in question shall also be reinforced with metal.

All beams or girders shall be reinforced with metal if necessary for shear. Other reactions, if necessary, shall likewise be reinforced.

Neither the reinforcing metal nor the concrete shall be subjected to combined stresses so as to exceed in combination the stresses allowable separately.

Wherever possible, beams and girders, and also their intermediate floor construction, shall be made continuous. Reinforcing metal shall be used for that purpose in the top of all connecting members at the point of support, and it shall be sufficient both in section and length to prevent fracture at the point of support when the connecting members are carrying twice their calculated loads.

The reinforcing metal in the bottom of a floor slab may be deflected to the top of the slab along the line of support, or separate reinforcing material may be used for the reinforcement in the top of the slab. In either case, however, if a part of the slab is considered as a part of the beam or girder, the reinforcing material used in the slab must cross the full width both of the beam or girder and the part of slab so considered.

The centering for the beams and girders of a floor shall be constructed in conjunction with the centering for the floor slabs which they support, and no centering shall be removed until all parts of the finished floors are strong enough to support themselves and the loads that may come upon them during construction.

Shear: Reinforced Concrete. Reinforced concrete construction shall be designed so that the shearing stresses, both vertical and horizontal, developed in any part of the construction, shall not exceed the safe working strength of the concrete as fixed in this ordinance, or a sufficient amount of steel shall be introduced in such position that the deficiency in the resistance to shear is overcome. This reinforcement to be part of or rigidly connected to the main horizontal tension bars.

When the safe limit of adhesion between the concrete and steel is exceeded, some provision shall be made for transmitting the strength of the steel to the concrete,

Columns: Reinforced Concrete. Reinforced concrete may be used for columns when the ratio of length to least side or diameter does not exceed 15. The reinforcing rods shall be tied together at intervals of not more than the least side or diameter of the column, or spirally wound steel may be used. No column shall be built less than 10 ins. in diameter.

When vertical reinforcement is used in columns, such as rods, they shall have full perfect bearings at each joint, and such joints shall occur only at floors or other points of lateral support, and a tight fitting sleeve shall be provided at all joints of vertical reinforcing rods.

The concrete shall cover the reinforcing bars at all points at least 1½ ins., and in calculating the strength of a reinforced concrete column this outside 1 in. of concrete shall not be counted as a part of the section of a column.

The axes of several columns acting continuously through two or more stories shall accurately coincide and the constructor shall make special provision to effect this result.

Wind Pressure. In the case of buildings in which allowances must be made for wind pressure, as provided in this ordinance, the reinforcing rods of columns shall be connected by threading the rods and by threaded sleeve nuts, or threaded turnbuckles, or methods equally effective and satisfactory to the Board of Public Works.

Tests. The contractor shall be prepared to make load tests on any portion of a reinforced concrete structure within a reasonable time after erection, as may be required by the Inspector of Buildings. Such tests shall show that the construction will sustain a load of twice that for which it is designed, without

any sign of failure, or, in the case of beams, girders or floors, without deflecting more than one seven-hundredth of the span:

Reinforced Concrete Walls. Buildings of Classes A and B having a complete skeleton construction of steel or of reinforced concrete, or a combination of both, designed to safely resist all of the strains caused by the dead weights of the structure and of the live loads and of the wind pressure within the safe limits of stress provided in this ordinance for each material used, may have reinforced concrete walls as specified.

Reinforced concrete walls shall be at least 6 inches thick. If the area of wall surface included between any two adjacent wall columns and adjacent floor girders exceeds 300 square feet and is less than 400 square feet, the thickness of the wall shall not be less than 8 inches. If such area exceeds 400 square feet, the wall thickness shall not be less than 12 inches, supported on the steel frame at each story. If the concrete be not reinforced the minimum thickness of walls shall be 12 inches.

In reinforced concrete walls the area of steel reinforcements shall aggregate 1 per cent. of the area of the concrete, one-half of which shall be placed vertically and one-half placed horizontally. No reinforcement shall be spaced more than 12 inches apart. Additional reinforcement shall be placed around openings, and all reinforcement shall be wired at each intersection. All reinforcement shall be rigidly connected at columns and girders to the steel frame.

Concrete and Sand-Lime Bricks as Building Materials.*

BY ALFRED G. PATTON.

Of all the natural products with which Providence has endowed man, there is probably none more valuable from a building standpoint than lime. In concrete we find it as a principal ingredient and its use in all bonding materials for building purposes is universal.

Cement, which we will consider first, is composed of three principal ingredients, from which its takes its properties, the first and most important of these being lime, which in Portland cement is found in quantities varying from 59 to 63 per cent. The second ingredient or ingredients are alumina and iron, varying conditions of use changing the proportions of the mixture. For instance, when the concrete is to be subjected to the action of sea water, iron is used, the alumina as much as possible being displaced thereby. These ingredients occur in cement in percentages varying from 9 to 11 per cent. The third ingredient used in cement is silica ranging in quantities from 19 to 23 per cent. There may also be present a small percentage of free lime and foreign substances of various kinds.

The first of these three ingredients, or lime, gives to the cement its adhesive qualities. The second ingredient or ingredients give to cement its hydraulic and quick-setting qualities. The effect of these latter constituents is considerably lessened after a given period varying from six months to a year, at which time the third ingredient or silica (which gives to the cement its hardening properties) becomes more and more effective. The silica is a very slow acting agent and does not begin to make itself very prominent in the formation of the silicate of lime until at least six months from the time of the original setting of the cement. The chemical action of the silica extends over a period of about two years during which time the cement continues to harden, but never attains the full strength that might be secured from a pure silicate of lime owing to the presence of the two elements mentioned in the second ingredient. Were it possible to eliminate the alumina and the iron which are necessary for the quick hardening and hydraulic as well as the quick setting qualities of the cement, after their work had been accomplished, the pure silicate of lime would be a much superior bonding material to the cement which is used at present.

In order to thoroughly comprehend our subject, permit me to hastily review the process by which the cement is manufactured or secured. Where high-grade Portland cements are to be made, a rough analysis is made of the rock in the quarry before the stone is quarried, so that proper proportions of the three ingredients may be found in the cement when completed. After being quarried the rock is placed in separate piles, again analyzed and mixture is proportioned from these piles. It is then dried and pulverized to a powder finer than ordinary household flour, after which it is again tested by the chemist for the actual proportions of its ingredients and corrections are made should it be found that the percentages vary materially from those given above. The powdered rock is then transferred to a rotary kiln generally heated by a flame generated by forcing pulver-

*A paper read before the Insurance Society of Philadelphia.

ized bituminous coal and air into the kiln. As the rock dust approaches the flame, it reaches a temperature of about 2000 degrees Fahrenheit. This high degree of temperature dehydrates or drives off all water from the rock, leaving a clinker which as it comes from the kiln ranges in size from that of a pea to that of a walnut, the particles of the raw rock powder having been fused together by means of the intense heat. To this clinker when cool is then added a very small percentage of plaster of Paris, not over 2 per cent., or in some cases pure gypsum; the heat developed in grinding the clinker reduces the gypsum to plaster of Paris. The action of the plaster of Paris tends to retard the quick setting properties of the cement. Were it not introduced the cement would set in a minute and a half to four minutes, after adding water, making it impracticable of use. Great care is taken that not more than 2 per cent. of plaster of Paris be introduced, as a larger quantity would likely be detrimental to the cement. The clinker is then ground to a fine powder known as cement. The cement should always be permitted to ripen at least two weeks (or longer, if possible) before being used, otherwise should there be small particles of free lime n the cement they may act against the bond, as I shall describe in a few moments.

Having driven the water from the rock by calcination, it follows that should water again be added an artificial rock will be produced. Not only is water driven off by burning, but all vegetable substances, and as the temperature rises to 1200 or over, alkalis and other foreign substances are driven off. The water is added when the cement mortar is mixed. The presence of free lime in the cements that have not properly ripened will after the setting deteriorate the cement for this reason. The hydraulic compounds setting as quickly as they do, do not give the free lime proper time to slack and to absorb the carbonic gas from the atmosphere, which is will naturally take up, therefore the mass is hardened before that chemical action is complete. Should there be free lime it will continue to slack and absorb the carbonic gas, and in doing so it swells, breaking the bond of the cement and disintegrating the mass. Where the cement is permitted to ripen, this absorption of carbonic gas is carried on in the cement powder before the water is mixed, and completed before the cement is to be used in mortar or concrete, so that you can readily see the necessity of proper ageing of all cements. A test known as the accelerated test, which is merely a boiling of the cement pats, develops any lack of proper ageing in the cement and should always be made where cements are to be used.

Having now considered the ingredients of cement and the manufacturing of same, let us for a few moments consider the application in the manufacture of concrete. Concrete is made by mixing together cement, sand and broken stone or gravel, cinder either of bituminous or anthracite coal sometimes being used as the latter ingredient, the proportions varying with the different classes of work and uses for which it is intended; a good average mix, however, would be in the proportion of one, two, five; one, two and one-half, five; or one, three, five. The mass is thoroughly mixed together and wet down with a proper amount of water and again mixed (either by hand or machinery) and is ready for tamping in place. Concretes or cement plasters which are rich in cement, or which are mixed neat, are very likely to crack and open seriously, due to shrinkage, and in the event of their being used in fireproof material exposing the steel work to the action of the flames. I shall not take your time to consider the question of the amount of water nor the application of the concrete, but will merely call your attention to the fact that if this concrete is again subjected to an intense heat, as it is likely to be in the case of a conflagration or a serious fire, the water may again be driven off and the clinker formed as it is in the manufacturing of cement. Just to what extent this dehydration of the concrete continues is a much mooted question which I am not prepared to discuss at this time, and which, in fact, I feel pretty certain very few are capable of solving, with the knowledge that we have of the subject at present. It is likely, however, that ordinarily the water of crystallization is not driven off to any serious extent except in cases where the temperature is excessively high and long continued, and even then should the work be properly done and the proper quality of materials used, it is exceedingly questionable whether the dehydration will extend any material distance into the concrete mass.

Having thus considered the manufacture of the cement and concrete, let us for a few moments consider its application in the erection of buildings known as reinforced concrete construction. Concrete while possessing qualities capable of resisting high crushing strains is not equally capable of overcoming high tensile strains and is, therefore, not considered a good building material in cases where it must gather up and sustain the latter

without being reinforced by some material that is capable of sustaining such strains. To illustrate this, let us suppose a reinforced concrete beam is constructed supported at both ends and loaded equally along its entire length. Should this beam be loaded with a burden heavier than it is capable of bearing, the greatest bending moment would be at the center of the beam and the rupture or break of the beam would be at that point. As the beam breaks, the particles composing the bottom face are torn apart or open, while the particles composing the upper surface of the beam are compressed together or crushed. This being the case, it is most necessary to gather up the tensile strength at the bottom of the beam by reinforcement, the material used having the possibilities of sustaining a high tensile strain. It is therefore customary to reinforce the beam by placing a steel rod or rods in same which, gathering up the tensile strain, holds the beam together. In earlier forms of reinforced concrete this rod generally extended along the entire length of the beam and is placed about five-sixths of the depth of the beam from the top. Later experience, however, has taught that it is wise to bend this rod so that after supporting the tensile strength at the bottom of the beam the rod ascends in an angle of about fifteen degrees to a point about one inch from the top of the beam and then passing horizontally along the top of the beam to each end it gathers up the negative bending moment and shear.

The negative bending moment may be better understood by the fact that as the beam breaks in the center with the rupture at the bottom and the crushing at the top it also bends at each support with the rupture at the top and the crushing at the bottom. The steel rod reinforces the top of the beam at the negative bending moment against the tensile strain which is exerted there. The cement having qualities capable of resisting a crushing strain does not need to be reinforced on the crushing side of the beam which sustains the crushing load. This rough outline of reinforced concrete will give in a general way an idea of the principle on which reinforced concrete is built, and you can readily see that in case of fire the reinforcing steel must be carefully protected from the action of the flames or heat in order that it may perform its functions in sustaining the load. Steel rapidly deteriorates in its capacity to sustain a load as its temperature rises, for instance while at 400 degrees Fahrenheit the tensile strength of steel is 100 per cent., at 800 degrees it is reduced to about 50 per cent., at 1050 degrees to about 30 per cent., so that you can readily see that where a building is figured with a factor of safety of four or even six, that factor is quickly eliminated by the raising of the temperature of the steel and it becomes all important to put sufficient covering of concrete over the steel to properly protect the same.

Having thus considered very briefly the subject of cement and reinforced concrete, let us for a few moments look into the question of construction of sand-lime brick and their usefulness as a factor in the construction of buildings which may be subjected to a fire test. Sand-lime bricks, unlike cements, are composed of but two ingredients. First, silica or sand (sand being from 90 to 95 per cent. pure silica), and secondly, lime. The quantity of lime varies in different make of bricks. An average, however, would be about 10 per cent. The manufacture of the brick is rather a simple process and is carried on in the following way: A clean washed sand is first heated in a kiln, the temperature of which is maintained by direct fire heat, this being done to thoroughly dry the sand, after which it is run off and, should the particles of sand be larger than good practice requires, they are ground in a cylindrical pebble mill which reduces their size.

The lime, which is first hydrated and then allowed to age, is mixed with the sand by mechanical mixers in the proper proportions and the proper amount of water is added. By the hydration of lime we mean the adding of sufficient water to slake or pulverize the lime, leaving a dry powder rather than a wet mass.

After mixing these two ingredients together with the water, the mass is carried to the press machines and under very heavy pressure, varying from 120 to 150 pounds per square inch, is formed into the brick shape. These bricks after being loaded on a steel truck are run into a steel baking cylinder about 7 feet in diameter, in which they are hermetically sealed and steam at a pressure of 125 pounds per square inch is introduced in the cylinder and the bricks are permitted to bake for a period of about ten hours, after which they are ready for use. While there is considerable question as to just what action takes place in these bricks, many believing that there no chemical, but merely a mechanical bond, yet it is claimed by the sand-lime people that a silicate of lime is formed which, if true, would make a very excellent building material. This fact, however, remains to be proven and experience and

observation would rather tend to raise a question in regard to it than to confirm the fact. It certainly would be wise to make thorough investigation into the construction of these bricks before permitting them to be used in any great quantities in buildings, so that their qualities may be thoroughly understood and the limitations of their possibilities fully known before their general use is permitted. There is a grave question in my mind as to the possibility of these bricks successfully resisting the action of fire; the interior wall of a building is the one, in case of fire, which is subjected to the most intense heat, and it is also the bearing portion of the wall, in buildings of ordinary construction, it being the custom to carry the floors on the inside four inches of the walls. If the bond which is made in these bricks be merely mechanical and subject to disintegration from heat, then the walls would be of little or no use for the purpose of carrying the weight of the building after having been subjected to fire. While it may be true that the claims of the sand-lime people can be proven or while it may be equally true that there is a thin veneer or silicate or lime formed on the surface of the sand particles which constitutes the bond holding the atoms of the brick together, yet, as I said before, these facts remain to be proven and we would be exceedingly unwise to assume that they exist without first thoroughly informing ourselves on these points.

Comparative Fire Tests of Sand-Lime Brick and Ordinary Building Brick.

Prof. I. H. Woolson made a series of tests of sample lots of sand-lime brick and of Philadelphia and Hudson river building brick, at the fire testing station of Columbia University, New York, the results of which he reported to the National Association of Manufacturers of Sand-Lime Products. The following are the results of the fire tests:

One of the principal objects of this investigation was to determine the fire resisting properties of these brick by a practical full size test in comparison with common clay brick. For this test the writer used the partition test house at his fire testing station at Columbia University.

This house is 14 ft. 6 in. by 9 ft. 6 in. on the outside, and consists of reinforced concrete walls and roof, while the side walls are removable. The floor of the building is a grate upon which the fire is built and suitable draft openings and chimneys are provided. The sides were built in as 8-inch walls with sand-lime brick for one, and common brick for the other. The work was done by regular brick masons who were instructed to make the wall a good average job—no better.

The brick were laid in bands about 14 inches wide. In order that each variety of brick might be subjected to the same heat conditions as far as possible, only half of a band was laid on the same level in the wall. The other half was placed in some other position. In a few instances there were not sufficient brick to lay the whole portion of the wall. In such cases the inside course of bricks next the fire was kept true to name, and the outside, where unimportant, was filled up with some other variety.

It was also decided to test the merits of lime vs. cement mortars along with the brick. For this purpose half of each wall was laid with the different mortars. The walls were 17 days old when tested.

Purpose of the Test. The purpose of the test was to determine the effect of a continuous fire against the walls for two hours, bringing the heat up gradually to 1700 degrees F. during the first half hour and maintaining an average of 1700 degrees during the remainder of the test. Then a one and one-eighth inch stream of cold water to be thrown against the wall for three minutes at hydrant pressure, which at this location varies from 25 to 30 pounds.

Temperature. The temperature of the fire was obtained by three electric pyrometer couples. One suspended through the center of the roof, hanging eight inches below the ceiling, and the other two inserted through the walls at the middle, about two feet from the top, one through each wall. Temperatures were read from each couple every three minutes. The temperature curves on all the points were practically the same.

The fuel was dry cord wood. Frequency of firing was governed by the temperature recorded.

To measure the heat transmitted through the walls by conduction a bare bulb thermometer was placed against the outside of each wall and covered with a box to prevent radiation. The rise in temperature on the sand-lime brick wall was 119 degrees F. and on the clay brick wall 74 degrees F. The moisture in the sand-lime brick was converted into steam and this aided in raising the heat.

Water. In applying the water through the door in the end of the building the stream was thrown back and forth over the whole surface of the wall as much as possible and not allowed to play continuously in one spot.

Effect of the Test. Several large cracks developed in both the sand-lime and the clay brick walls during the test. These were no worse in one wall than in the other and were expected, for all walls, whether brick or concrete, form these expansion cracks during a fire test. It was not apparent that the kind of mortar had any effect upon the tendency of the wall to crack.

A furious fire was maintained for the allotted time, at the expiration of which the water was applied in the regulation manner. With the exception of the surface deterioration the walls were solid and in good condition. After they were cooled the inside course of each wall was cut through and specimens of each series secured for examination and test. This opening was made at the middle. It was about three feet wide and extended nearly across the building vertically. It was very difficult to secure whole bricks, owing to the extreme brittleness. We en-

deavored to secure two samples from each series to test without tearing down the whole wall and in most cases were successful.

Condition of Each Series After the Fire. The letters indicate the various lots of samples tested:

Sand Lime Brick. A—Appeared in good condition in wall, but were found very soft and tender upon removal.

B—Practically same as A. Two bricks were spalled off by water 1-8 inch deep.

C—Somewhat cracked by water, particularly along lamination crack at middle. Badly cracked on surface but whole bricks could readily be obtained.

D—Surface washed away by water on about half the bricks. Bricks were tender and broke easily in several pices. Difficult to get whole brick.

E—Surface badly washed by water to a depth of 1-8 to 1-2 inch. Tender and easily broken.

F—These bricks contained many quartz pebbles 1-2 inch or more in diameter. These pebbles burst on the surface and tore away the brick. General appearance bad. Many cracks.

G—Surface a little wasted by water, but brick in very good condition. Whole brick easily obtained. Few cracks.

H—Few cracks. Good condition.

Clay Bricks. I—Full of cracks. Very difficult to get whole brick.

I2—Many pieces spalled off by water. Bricks very badly cracked in wall. Could not secure a whole brick. Poorest of clay bricks.

J—These "salmon" brick seemed to withstand the fire the best of the clay bricks. However, a large percentage of them showed cracks.

K—Badly chipped and cracked. Whole brick very difficult to secure.

L—Same as K.

In general, the bricks were affected by fire about half way through. They were all brittle and many of them tender when removed from the wall. With the sand-lime brick, if a whole brick broke the remainder had to be chiseled out like concrete, whereas, a clay brick under like conditions would chip out easily. The clay brick were so brittle and full of cracks that the wall could be broken down without trouble. The sand-lime bricks adhered to the mortar better, were cracked less, and were not so brittle. These conditions made their removal much more difficult. They will doubtless get harder as the water dries out of them.

The clay brick cracked and spalled; the sand-lime brick washed away on the surface and became tender. It was difficult to find a clay brick that was not cracked in two or more pieces as they laid in the wall, but there were many sand-lime bricks that were apparently free from cracks. However, they were very apt to break in prying out. The half bricks from the clay wall when struck with similar sand-lime brick would, in most cases, shatter first.

The transverse strength was extremely low in all the brick but the compressive strength was very much higher in proportion. The strength of the clay brick was a little superior to the sand-lime in transverse, but at best they were bad. No advantage was evident in compression.

Since this paper was written large parts of both the walls submitted to the fire test have been cut out, and it is my candid opinion that the sand-lime bricks were in much better condition than the clay bricks. This opinion is emphatically endorsed by the brick masons who did the work, also by others who examined the walls.

Your secretary, Mr. Duerr, informs me that he has made a study of the strength data presented in this paper, in reference to the percentage of lime used in each variety of brick. He found the relative strength value of each kind of brick per 1 per cent. of lime, by dividing the different strength values given, by the per cent. of lime used. In this way he was able to eliminate many of the apparent variations, and explain the seeming inconsistencies.

As a result of his investigation, he found that the bricks made with lime carrying magnesia were considerably weaker per per cent. of lime used than those in which a high calcium lime was employed. It was also evident that too much lime weakened the brick. The indications were that no benefits were derived from lime in excess of 6 to 8 per cent.

Ordinance to Regulate Concrete Construction in Pittsfield, Mass.

Section 1—The provisions of this ordinance shall apply to the structural use of concrete in all buildings within the fire limits. The inspector of buildings may impose such conditions and restrictions, in addition to those hereinafter contained, not inconsistent with general law or with the provisions of this ordinance, as to the strength and dimensions of material, and as to the methods and details of construction to be employed, as he may deem necessary or expedient, for the safety of life and limb and for the prevention of fire.

Section 2—When the structural use of concrete is proposed, a specification of the kinds, quality and proportions of materials to be used and of the method of manufacture shall be submitted to the inspector of buildings who may issue a permit at his discretion, having regard to the factors of safety, strength and durability.

Section 3—For a pier or column whose height does not exceed six times its least dimension, the concrete shall contain one part of first class Portland cement to a maximum of six parts of a properly graded aggregate of stone and sand. The compressive stress shall not exceed thirty tons per square foot.

Where maximum stress or stresses that approach the maximum as provided in the two preceding paragraphs, are used, the inspector of buildings may require some satisfactory form of metal reinforcement to the concrete.

Where the shearing stresses exceed thirty pounds per square inch of concrete such reinforcement as the inspector of buildings may require must be provided.

Section 4—The concrete for steel-concrete beams or slabs shall contain one

part of first-class Portland cement to a maximum of five parts of a properly graded aggregate of stone and sand. The compressive strain shall not exceed 500 pounds per square inch.

The entire tensile stress of a steel-concrete beam or slab which is subjected to bending stresses, shall be carried by the steel, which shall not be strained above the limits usually allowed for this material.

Section 5—The materials forming the aggregates of stone and sand described in sections 3 and 4 are to be measured loosely by volume before mixing. The cement is to be measured as packed in barrels for delivery.

Section 6—Artificial stone, made of Portland cement and non-combustible fireproof and waterproof materials may be used as a substitute for any natural stone.

Portland brick made of Portland cement and some inert material, may be used as a substance for common brick.

Portland building blocks may be used as a substitute for bricks in buildings which do not exceed four stories in height.

Section 7—Portland bricks shall be bricks.

Section 8—The hollow spaces in Portland building blocks shall not exceed one-third of the area of the block. The block shall have an annulus of uniform thickness, shall not exceed 9 inches in height and shall not be less than eight inches in height, and shall not be less than eight inches on the bed. An eight-inch block shall be deemed equivalent to one brick in thickness or measure and the increment of increase of the thickness shall not be less than four inches for one-half brick.

Section 9—Artificial stones, Portland bricks or Portland blocks shall not be used until they are thoroughly set. Except as the inspector may otherwise permit, three weeks shall be the minimum period between the making and the use thereof. They shall contain one part of first-class Portland cement to a maximum of four parts of a properly graded aggregate of gravel or stone and sand. No coloring matter that will materially impair the strength of such stones, bricks or blocks shall be used in their manufacture.

Section 10—All concrete work, except as herein provided and except such as may be approved by the inspector, shall be equivalent in every way to the following: One part of first-class Portland cement, two parts of sand and four parts of broken stone or screened gravel, properly graded so that all voids shall be completely filled. The kind and quality of all material used in concrete work and the method of manufacture shall be subject to the approval of the inspector.

Section 11—Upon request of the inspector, the contractor or owner shall submit samples for load tests on any portion of a concrete or concrete-steel construction. The tests shall be made by the inspector and shall show that the construction will sustain, without any sign of failure, a load not less than three times for which it is designed.

PAVING

Paving in the Southwest—Tarring Streets in France—Chicago Asphalt Inspection—Chicago Guaranteed Streets—Philadelphia Asphalt Contracts—Michigan State Roads—Manila Paving.

Paving in the Southwest.*

BY WALTER F. REICHART, TEXARKANA, TEX.

Paving bricks are manufactured in a number of cities of the southwest, but the best grades come from Kansas and Arkansas, the former being the better brick. In the manufacture of paving brick as in the construction of the brick pavement itself, different results are obtained with the same materials due the difference in handling same. In one case the brick is soft and does not stand wear at all, while another, made in the same locality, is hard and absorbs but little water and stands traffic very well.

In the state of Arkansas, the brick pavements have been constructed on a very cheap basis. In most cases no foundation other than the natural earth has

*From a paper before the American Society of Municipal Improveemnts.

been used. In the city of Little Rock two brick pavements were constructed about fifteen years ago on a clay or natural earth foundation, and remarkable results have been obtained. In the construction of this class of pavements the subgrade was prepared just as though a concrete foundation was going to be used. After the subgrade had been properly rolled a cushion of sand about 1 1-2 inches thick was spread on top, after which the paving brick are laid on edge and the joints filled with sand. In the case of the above city these two pavements have given excellent results and it is doubtful if the other brick pavements in that city constructed on concrete foundation will give much better. In the city of Fort Smith, Ark., the pavements in most cases will be brick and will have no other foundation than the natural earth with a four-inch sand cushion. The bricks will be laid on edges and will be thoroughly rolled with a heavy roller. The price for this class of pavement was 83 cents per square yard, which is exceptionally cheap for any kind of pavement.

Another method of constructing brick pavements that has struck the writer very forcibly as being one of the best, if not the best method, is in use in Pittsburg, Kan. In the construction the subgrade is prepared in the usual manner. On top of the subgrade is spread a four-inch layer of cinders which are sprinkled and thoroughly rolled with a roller weighing not less than five tons, after which a layer of hard burned vitrified brick is laid flat-wise and close together, with the long edge parallel to the curb line. Then on top of this platen course of brick is spread a one-inch layer of sand, which is shaped to the finished contour of the pavement by means of templets, making the pavement ready for the top layer of brick or wearing surface. The top layer is composed of the best hard-burned brick and the bricks are laid on edges with a sand filler. After the joints have been filled with sand a thin layer of sand is spread over the entire surface. In rolling the top layer a roller weighing not less than five tons is used, and that part of the pavement which can not be rolled is thoroughly tamped. The contract prices for this class of pavement were $1.20 and $1.26 per square yard.

This pavement can be constructed at small cost and is not near so noisy as the brick pavement laid on concrete foundation.

The method that is perhaps most used in the larger cities and that is being used to some extent in smaller ones, also, is the laying of brick on a concrete foundation with sand cushion.

This method is more costly than any other, both from the cost of material and of supervision necessary to secure good work. The writer seems partial to the pitch or asphalt filler, as the pavements which he has investigated and are filled with cement grout appear to be very noisy pavements. The cost of this class of pavement where crushed stone is plentiful varies from $1.80 to $1.90. However, in Fort Smith the price was $1.46 per square yard.

A pavement that is becoming more popular in the southwest is the asphalt pavement, and this is due to the fact that a very fine grade of rock asphalt has been found in these states. Of asphalt pavements now being laid, rock asphalt seems to be in the majority, as it has been shown that this grade will stand the warm temperatures. The rock asphalt is found in large quantities in Arkansas and the Indian Territory, the former being richer material and the writer believes will stand more wear. The territory asphalt has been used a great deal in Texas and has given good results, while the Arkansas material has been used only in that state. The rock asphalt pavement is constructed in the same manner as the old asphalt pavements, with the exception that a binder course is not used. The asphalt is ground, after which carbonate of lime is added and the mixture dumped into a mixer. After the material has been thoroughly mixed it is shoveled into a heater, where it is raised to a temperature of 250 to 300 degrees Fahr. It is then hauled to the street, where it is raked and rolled as any other asphalt pavement. In the mixing of rock asphalt great care must be exercised, as the material as a general rule runs irregular in percentage of bitumen, and therefore requires constant testing in the laboratory. The amount of carbonate of lime that is added to the mixture, of course, depends upon the percentage of bitumen that the material contains. The writer has used the Territory, Arkansas and also the Kentucky asphalt and finds that a good pavement can be had from use of each kind if it is properly handled and that no fixed rule can be applied to the handling of any, as constant experimenting and testing of each is required. Of the three asphalts mentioned the writer has found the Arkansas material, which is the richer, to be the easiest handled and, owing to its large amount of bitumen, exceptionally good for asphalt macadam. The asphalt macadam has become very popular and owing to its small cost, as compared to the other pavements, will become more popular and will be used extensively in

residence districts. An asphalt macadam has the same appearance as sheet asphalt and is as easily kept clean, its surface being smooth but not slippery.

The Arkansas rock asphalt macadam with which the writer has had experience is constructed as follows: The subgrade is prepared in the usual manner; however, great care is taken in removing the spongy places and refilling with good material; and is thoroughly rolled. On top of the subgrade is spread a layer of stone, the largest of which will pass through a 3-inch ring. This layer is then thoroughly rolled, after which a one-inch layer of sand is spread and rolled, thereby filling, to a great extent, the voids of the stone. On top of the sand and stone is placed another three-inch layer of stone of the same size as base material. The entire pavement is again rolled and is then ready for the wearing surface, which is three inches in thickness and consists of a mixture of ground asphalt and crushed stone, the largest of which will pass through an inch ring. After this mixture has been spread the entire pavement is again rolled with a heavy roller, and after sprinkling or sweeping cement over same, the pavement is ready for traffic. This pavement increases in hardness by the traffic as it becomes more packed. The cost of this pavement in the city of Little Rock, where crusher rock is plentiful, was $1.40 per square yard. This macadam is not an experiment, but has been proven to be a popular pavement as well as a lasting one. However, this like all other pavements, requires attention and must be kept clean, as we all know water and filth cause deterioration of any pavement.

An advantage that the macadam has over the sheet asphalt pavement is that it is not slippery, and never becomes so, the stone in the pavement affording a footing for the horses.

Another pavement used to some extent in the above section is the bitulithic, and, like all other pavements, has given both good and bad results.

In the business districts of some of the old cities we find the granite block pavement which, in most cases, have been been down for years and are still good for many more years. The writer is of the opinion that the cities in this section now having the granite block pavement will replace same with asphalt or some other good pavement, excepting where the granite is in wholesale districts.

The wooden block pavement has been used in but very few cities and in some cases has not proven a success, but if the blocks now being laid in the east were used this pavement would become very popular.

As a general summary, the writer will state that paving has to a great extent been neglected in the southwest, but that more work has been done in this line in the past three years than any time previous, and that with the good roads movement on through all sections of the country, there will be greater activity in street paving. I have also noticed that most of the cities are without street cleaning departments and that the streets are practically neglected and are not kept in a good and sanitary condition. This, perhaps, more than any other cause is the reason why so many pavements fail and do not meet the requirements. For this reason asphalt pavements have not been used as much as other pavements, as this pavement must be kept clean and sanitary to give good results.

Owing to the large amount of oil in the Texas fields, the use of oil on macadam roads has become popular and is used a great deal and with good results in small towns where the more costly pavements can not be laid.

Chert and trap rock are found in Missouri and Arkansas, and are excellent materials for macadam.

Results of Coating Streets with Tar in France to Eliminate Dust.

The following article was translated from an article by Dr. Guglielminetti in the *Journal Fuer Gasbeleuchtung*, by Mr. Frederic Egner, and printed in a recent number of the *American Gas Light Journal*. The method of distributing the tar over the surface and the apparatus for doing the work is described in greater detail in an earlier article on "Method of Road Tarring in France."

Four years have passed since the publication of our earliest successes with tar coating streets and roadway at Monaco and Paris. At first this method of treating roadways gave rise to some misgivings on the part of tar and asphalt experts, and especially among street engineers, who doubted that a thin coating of tar upon the surface of much used roadways would for weeks—not to say months—be able to successfully resist the formation of street dust.

Today, after four years of observation of a number of kilometers (1 kilometer equals 0.62 mile) treated in the manner hereinafter described, the French street engineers have given their verdict on the subject, and in order that all countries might profit by the experiments made in France, and for the sake

of street hygiene, we give this abstract of the report concerning tarring of roadways, which was published in the "Annales des Ponts et Chausses" (No. 39, 4me trimestre 1905, Editeur Bernard, 1 Rue Medicis, Paris).

Mr. Heude, engineer of the Department of the Seine and Marne, reported that he tarred, in the summer of 1903, about 215,200 square feet; in 1904, twice as much; and in 1905, more than 1,291,200 square feet; and he asserts that the results were, throughout, excellent. The dust resulting from the wear of the streets had almost entirely disappeared, and naturally the "wear" itself was enormously reduced, which meant longer duration. That, together with the reduction in cost for maintenance, more than pays the first and subsequent cost of installation of the street tarring apparatus. And, whereas formerly the sprinkling and cleaning of the streets cost considerable sums, this method actually caused a net profit of 1 cent per square meter (= 10.76 square feet) for the year. It is by no means any longer an experiment, but the method has been demonstrated to be practical. During summer there is little dust and in winter but little mud. From now on all newly made streets and roadways will be tarred.

Engineer Sigault makes the following statement: As the best evidence of the excellence of the new method, it may be mentioned that the residents of our communes request its use, and willingly volunteer to share in the first cost of its installation. The method was somewhat rapidly introduced. In the year 1902 but three of my superintendents commenced the tarring, while now eight of them are doing it. He speaks of the following decisive experiment: A much used roadway was made over for a distance of 3,608 feet in 1902. For a distance of 1,640 feet this roadway was tarred then, and in the following three years. At the end of 1905 the tarred end of this road was in still entirely good condition, while the portion which was not so treated had to be recovered in the course of the year 1905. Another experiment: Two adjoining identically conditioned portions of a roadway, each having an area of 1,100 square meters, were newly covered in 1902. One of these section of road was tarred, the other not. The following winter the untarred section had to be swept nine times, the tarred one only once. From the untarred section 24 cubic meters of mud had to be removed; from the tarred one only 2 cubic meters, and this was mostly brought on to it from the adjoining sections. With the view of preserving the roadway the section having to bear the heaviest traffic was tarred. These two experiments were convincing.

Mr. Girardeau, of Fontenay-le-Comte, claims, after many years of experience with the system, a saving of 25 per cent in maintenance of streets by means of it. Mr. Vahheur, city engineer of Paris, had about 50,000 square meters of streets surrounding Parc Monceau, tarred, and is very pleased with the results. No one these days complains about insufficient sprinkling of the street, and the residents can again keep their windows open all through the daytime. Mr. Arnaud, engineer of the Department of the Seine, considers the tarring of the streets as a most excellent and practical means to suppress the dust of the streets.

Streets around Paris which formerly—that is, before the tarring—required recovering every three or four years, were tarred duing the summers of 1903, 1904 and 1905, and are now in such good condition that there will be no need to recover for some years to come, and one year's postponement would richly pay the cost of all the tarring.

The method to do this may be gathered from the brief description, of which the following is a free translation: In the heating wagon the cold tar is poured into a vessel, over which is situated a large heating kettle, which is a closed vessel like a boiler, and is connected with a small steam boiler. The arrangements are such that steam may be blown direct into this heating kettle or boiler; or, if desired, can be conducted into spiral pipe coils inside of the same kettle.

The kettle is first filled directly with steam; then cold water is poured over it, causing the steam to condense, and the resulting vacuum will draw about 1,000 liters (about 264 gallons) of cold tar up into the heating kettle, through a pipe which connects the same with the tar reservoir on the wagon. Now steam is admitted into the coils mentioned and the tar is brought up to a temperature of 100 degrees ((no doubt Centigrade, or about 212 degrees F.), and at the same time steam is also admitted into the kettle direct, by which means the boiling tar is forced down and through a pipe into the sprinkling wagon standing alongside. As soon as the heating kettle is empty the steam is again condensed as before, and the operation repeated as often as may become necessary. Tar brings about a sort of hardening of the surface of the roadway, which is very desirable for the traffic on macadamized streets, especially where a sort of tar asphalt is thus formed, as pointed out by Privy Councillor von Leyden.

While in these days of "automobilismus" a somewhat durable good effect can only be obtained by either sprinkling the roadways so heavily as to form mud, or else to sprinkle lightly every hour, which tends more or less to hinder free traffic on the sections of road undergoing treatment for the time being, tarring reduces the dust nuisance to an inconsiderable minimum, for which a light sprinkling twice each day will suffice to obtain a really satisfactory result.

No mud is formed upon the water-tight surface any more than with asphalted streets. Tar asphalt will last about eight to ten months, while asphalt pavements will last eight to ten years. But the latter costs 15 francs per square meter, whereas the tar asphalt costs only one hundredth as much, and even this small sum is recovered in the saving by lesser cost in maintenance and wear of roadway. This advantage from a financial viewpoint has overcome many an engineering official objection when the hygienic advantages were entirely ignored. Very likely it was also the financial aspect of the matter which caused more attention to be given to the mechanical means to accomplish the work, and the former primitive method of heating the tar, and then by means of hand sprinkling cans, brooms and much labor, to spread the tar heated up to about 70 degrees evenly over the surface of the roadway, has ben now superseded by the large tar heating wagon in which 264 gallons of tar can be heated every 20 minutes by means of steam and without danger of taking fire and pumped over into the sprinkling wagon, on the rear end of which large mechanically moved brooms spread the tar over the surface of the roadway. In this manner more than 107,600 square feet can be tarred inside of four hours. The tar sprinkling wagon carries a large barrel out of which the tar flows into a basin in which the pressure is always the same. From this basin the tar flows into a distributing pipe with holes, calculated on the distance of a horse's step, and that in such distance about 600 grammes of tar are distributed over each square meter of surface (1.32 pounds tar to each 10.76 square feet). Since 2.64 pounds, or 1,200 grammes, are required per each square meter, to make a good job of it, the same ground is passed over twice. As the brooms at the rear end of the wagon distribute the tar automatically, one laborer is enough to follow the wagon to fill in possible vacant spaces which the revolving brooms could not reach. To insure the best results the work should be done during clear, warm weather; the roadway should be well cleaned and perfectly dry; two and a scant three-quarter pounds of tar to every ten and three-quarter square feet of roadway, but on as hot as possible, and well spread, and over all a little sand is to be sprinkled. One-half of the street (in width) is tarred at a time, and then the tarred portion should be closed to traffic for 24 hours. If these directions are followed the success of the work is assured.

To partly meet the expense of the first time of tarring a roadway, the financial aid of the public, which is certainly interested in the highest degree in this improvement, would be desirable. Owners of hotels, shops and tradesmen of all sorts who are more or less affected by the dust nuisance; physicians and others who may well find it to their advantage to see a system inaugurated which will positively eliminate dust from the streets and roadways, ought to get together and use such means as they can command to bring about this really possible and so greatly desirable result. If these lines contribute anything to further the good work their object will be accomplished.

To these words the translator begs leave to add a suggestion or two. Owners and users of automobiles or carriages of any sort might be added to the list of those who are interested in seeing the street dust laid; so are pedestrians who are obliged to walk either for business or pleasure. And last, but by no means least, the tar producers should take a the people who suffer by reason of the dust nuisance, and to the notice of the officials who can—now that a way has been shown by such good authority as is herein quoted—lay the dust.

Railroad companies also might find it to their financial interest as well as greatly to the comfort of their passengers and other patrons to give this method of dust prevention their serious and favorable consideration, and in this connection they might take notice that coal tar is not exactly a fertilizer, but quite the contrary, and by a light occasional sprinkling of their roadbeds weeds would be annihilated and kept away, and iron as well as wood coming under the tar sprinkler would experience a lengthening of life and usefulness, much to the financial advantage of the railroad company who may give this recommendation serious thought.

Asphalt Inspection Bureau of Chicago.

The board of local improvements of Chicago has recommended to the financial committee, in its budget for 1907,

the establishment of a bureau of asphalt inspection. This bureau, which would cost annually from $10,000 to $12,000, is to give expert advice to the contractor when the asphalt is laid. At present the city is protected by a five-year bond, which each contractor gives that he will restore the pavement if during the period it does not wear equal to specifications.

Trouble With Guaranteed Streets in Chicago.

The aldermen and citizens of Chicago have denounced the policy under which miles of thoroughfares have been improved in that city at the expense of taxpayers, only to fall into decay in a comparatively short time. Suits will probably be instituted at once against contractors under their guarantees for defective asphalt paving constructed in nine of the city's streets. The law department of the board of local improvements has experienced so much difficulty in forcing repairs under guarantees that part of the contract price is now withheld until the end of the five-year term of guaranty.

The board of local improvements has thirty-one cases filed against street paving contractors, and of this number nine are for asphalt pavement which has disintegrated within the guaranteed period.

Philadelphia's Asphalt Contracts.

In an ultimatum sent to the Barber Asphalt Company, December 11, John R. Hathaway, director of public works of Philadelphia, notified the company that unless the work of repairing certain streets was begun December 13, he would annul that company's contracts. If the contracts are annulled bids will be advertised and new contracts awarded as soon as possible. Director Hathaway stated that he proposed to instruct the city solicitor to take legal action against the Barber Company to make restitution wherever inferior materials not provided by contract had been used.

Director Hathaway wrote the company as follows:

Relative to the slag contained in the concrete, you will note that section 15 of the specifications provides:

All concrete shall be composed of one part cement, three parts of approved "Jersey hard gravel" or stone grit, and six parts of hard stone or slag of approved quality, free from dust or dirt, broken so as to pass in every way a two-inch ring, and thoroughly screened to reject all pieces having a diameter less than one-quarter of an inch. The "Jersey gravel" or stone grit shall be composed of grains graded from fine to coarse, thoroughly screened to reject all particles of a greater diameter than one-quarter of an inch, and shall be free from all loam, dust or dirt.

This I am bound to adhere to, conditioned upon your furnishing slag of such quality as I can approve. My only reason for requiring stone was that the slag you had upon the streets and all that you submitted was of such an inferior grade as was entirely unfitted for the use to which it was to be put. I stand ready now, as I have at all times, to permit the use of anything contained in the specifications that shall be of such quality as the specifications intended should be used. In short, if you will furnish slag which this department can approve, it will be accepted instanter; otherwise I will adhere to the requirement that hard stone must be used.

Therefore you are hereby notified to immediately proceed within forty-eight hours to complete all work under contract in accordance with the foregoing requirements, otherwise the annexed list of contracts will be annulled, in accordance with the authority contained in said contracts, and such other proceedings will be begun as may be necessary in the premises.

Director Hathaway claims that he was told that for ten years the Barber Asphalt Paving Company had used slag in the binder course in place of the required rock. Also, that the directors preceding him had permitted the use of the slag, there having been an understanding to that effect.

City Ordinances Effective on Passage in Kansas.

A decision handed down by Judge Gillpatrick, December 8, held that an ordinance passed by the city of Leavenworth, Kan., became effective immediately upon its passage, and not when it is published in the official papers of the city. The opinion was rendered in the case of James Byers et al. against the city of Leavenworth, enjoining it from collecting the special tax for the paving of South Fourth street, from Cherokee to Elm. The city council passed an ordinance ascertaining and notifying the property owners that the street would be paved and of the amount of special paving tax they would have to pay. The property owners protesting against the paving of the street filed their objections according to the ruling of the judge, thirty-one days after the passage of the ordinance, and not thirty, as is required by law. The plaintiff's attorney contended that the thirty days statute of limitations ran from the date of the publication of the ordinance. City Attorney Fitzwilliam cited a recent decision of the state supreme court, to the effect that the ordinance became effective upon its passage in the council chamber, this being the offi-

cial act and the publication merely a notice of the city clerk to the residents of what had transpired in the council meeting.

A New Method of Laying Street Railway Tracks.

The design of a street railway track foundation which will be rigid and at the same time elastic enough to suit the demands of travelers and the car repair shop; which will be permanent in its nature, but with parts easily removable, so that worn sections can be readily replaced and breaks can be easily repaired, has long been one of the difficult problems of the street railway engineer.

STREET RAILWAY FOUNDATION.
Under construction.

Mr. R. D. Culver has recently invented a method of construction of the foundation for the street railway rails and of fastening the rails thereto, which promises to meet the requirements of the service very satisfactorily. He first constructs longitudinal concrete beams of sufficient depth, width and weight to carry the traffic successfully. The two beams or longitudinal ties are entirely independent of each other, so that a defect in one need not be spread to the other. In the top of these beams, as shown in the right hand one in the first of the accompanying photographs, are constructed rectangular recesses of two kinds, located alternately and at suitable distances apart for locating supports

The larger series of these recesses is for the rails and fastenings for them. deep enough to permit a layer of dry sand or other cushioning material of proper depth for good service. There is independent access to this sand layer from the outside of the concrete. On top of this sand is placed a block of some suitable material, which projects slightly above the upper surface of the concrete beam and serves as a support for the rail. In the photograph referred to, these blocks, made of vitrified clay, are seen on the right, ready to place in position, and on the left in position ready to receive the rails. The blocks shown are grooved to fit the width of base of rail loosely. The blocks may be made smooth and they may be made of creosoted wood if greater resilence is desired than the cushion below will give.

STREET RAILWAY FOUNDATION.
Track laid ready for pavement.

When the blocks are carefully adjusted for height and alignment a thin coat of tar or asphaltum is put on top of the sand cushion, the blocks are put in place and the bituminous filler is run round the block, thus giving a watertight joint and a sufficiently elastic binder of block to beam.

The rails are fastened to the concrete beam at the smaller series of recesses. Below in the beam are rods or anchors on which the fastening bolts are hooked. These bolts are then fastened rigidly or like spike fastenings to the rails. When fastenings are fully adjusted so that they are secure and still have elasticity of connection and sufficient allowance for slight movements, the recesses are filled with sand or similar filling and covered with a good coating of the bituminous mixture used in setting the blocks, thus making the smaller recesses also waterproof.

The second photograph shows a completed section of track with a light T-rail in position. This track is now ready to receive the street pavement, which, with foundation and wearing surface, will fill the space between rails and tracks.

The advantages of this method of construction speak for themselves. The writer has seen the section of track shown in the photographs after it has been in use for two or three months on the industrial railway shown, where it has as heavy loads as any street railway track is called upon to carry. The solidity of the construction, its resilience and its probable durability are evident on inspection. Differences in local conditions will call for differences in form and material for blocks and for fastenings but the principles will doubtless be those stated above. The inventor is thoroughly testing all these things and has thus far met with gratifying success in all respects.

GARBAGE AND SEWAGE

Refuse Destruction in New York—Saratoga Septic Tank Explosion.

Refuse Destruction for the Borough of Richmond, New York City.

The following statement regarding the adoption of mixed refuse destruction for the Borough of Richmond, New York city, gives the reasons which led to the determination of the form of specifications and contract, bids on which are received December 27, as this number of MUNICIPAL ENGINEERING goes to press.

The closely inhabited section of Richmond Borough or Staten Island, in the City of New York, is divided into two refuse collection districts, each about four miles long by two miles wide, and containing in all approximately 60,000 people. In the West New Brighton District, garbage is burned in a Dixon crematory. In the Stapleton District, refuse is mixed and used for filling low lands.

Dumping places were sources of nuisance, and the haul from centres of collection to places of disposal increased year by year. Destruction by fire of decomposable refuse was the only practical means available because of the location, population and topography of the districts under consideration. In 1903, a plan for refuse removal from central storage stations to an outlying crematory was devised, but the street railway company failed to agree upon a reasonable rate of transportation, and after various inquiries, examinations and studies, no existing garbage crematory was found which offered hopes of satisfying the conditions of sanitary and economical final disposition. Thus a radical change in former methods became necessary.

After a study of available technical publications, it appeared that the British method of destroying mixed wastes offered hopes of solving the problem, provided the refuse materials were self-combustible, upon which point there was much doubt. In May, 1904, work was started with the object of obtaining definite information concerning:

First, the quantity of refuse contributed per capita per annum by volume and by weight.

Second, the seasonal variations in quantity of refuse by volume and by weight.

Third, the components of refuse and their seasonal variations.

Fourth, the calorific power of refuse.

Fifth, Practical tests in burning local mixed household refuse by means of forced draught.

It was believed that by determining the foregoing factors, a method might be devised for dealing with the refuse of the Borough, should mixed refuse destruction prove unsuitable. As a result, however, of the various tests, recommendation was made in December, 1904, for the erection of two furnaces of the British type, one for each refuse collection district.

Pending the acquisition of property for the erection of the first installation serving the West New Brighton district, thirty-nine destructors were visited in Great Britain and one in Canada, and the experience thus gained resulted in requesting proposals for a type of destructor which promised to meet the conditions

of the West New Brighton district in a sanitary and economical manner.

The Greater New York charter requires that for all patented articles competition shall be secured, and as the various modern destructors differ in dimensions and features of design, it was necessary to provide some general basis upon which bids could be secured. At the same time, it was felt that untried or experimental furnaces should not be given consideration, and requirements were introduced in the specifications and contract which made it necessary for contractors to present evidence of previous successful experience in dealing with mixed household refuse.

The plan for the destructor building contemplates tipping of refuse behind closed doors, hand feeding at the back of the furnace, with clinkering at the front and the dropping of heated clinker to a lower floor level, utilizing, if possible, any waste heat from the clinker in raising the temperature of air for combustion. A water tube boiler was specified and forced draught required.

The various tables shown in the specifications give contractors sufficient information regarding the character of the materials to enable them to figure on the probable success in meeting the requirements of the guarantees.

The work was carried out by J. T. Fetherston, Superintendent of Street Cleaning since May, 1904, with the advice and support of Mr. Louis L. Tribus, Consulting Engineer and Acting Commissioner of Public Works.

Following are some extracts from the specifications showing the requirements and the general manner in which they must be met:

The district to be served by the West New Brighton refuse destructor contains a population of approximately 26,000 people, contributing at present from 30 tons in summer to 50 tons in winter of mixed household refuse (ashes, garbage and rubbish) per work day. The district contains private residences, stores and tenement houses, with some manufacturing establishments.

The destructor contractor furnishes general plans upon which the city arranges for the construction of the building, foundations, runway, connecting flues and chimney at the city's own cost and expense. It is hereby understood and agreed that the city may modify the contractor's plans for foundations, building, runway, connecting flues and chimney as may be necessary or advantageous in order to meet the requirements of local conditions, but not in any way to materially affect the portion of the work to be erected by the contractor.

The contractor shall furnish complete plans, specifications, supervision, labor, materials and appurtenances necessary for the erection and completion of the destructor itself. These plans and specifications, together with all work, materials and appurtenances necessary for the erection and completion of the destructor shall cover the cells or units complete, the flues (not a part of the building), combustion chamber, regenerator or air heater, boiler, apparatus for forced draught, dust-catchers or dust-traps and such other necessary appurtenances as are required in the destruction of mixed refuse.

The destructor shall be capable of destroying 60 tons (2,000 pounds per ton) of mixed household refuse (ashes, garbage and rubbish) per 24 hours under normal working conditions, when the material is such as is contributed during the winter months, noted under heading "Composition of Refuse" in a succeeding paragraph. Provision for a future extension to 120 tons ultimate capacity of plant should be made.

The layout provides for tipping refuse behind closed doors into a storage hopper capable of holding 120 cubic yards (60 tons) of refuse; back hand shovel feeding of refuse from storage hopper direct to grate in cell or cells, with clinkering at the front, and provision for dropping hot clinker through the floor to a lower level, using the heat abstrated from the clinker in raising the temperature of the air required for combustion, if it is practicable to so utilize the otherwise wasted heat, or else the clinker hopper to serve as a storage and cooling chamber. The products of combustion pass on to a water tube boiler situated at a lower level than the cell or cells, from whence the gases escape to the chimney situated near the southerly line of the property. Space is left for an engine room and clinker machinery room, wherein the power may be utilized as may be deemed advisable after the available energy has been determined in actual practice. Ample room is left for the installation of a clinker utilization plant. A mess room under the tipping platform is also proposed, where toilet, bath and locker facilities may be provided. Space for an additional 60-ton furnace to be erected in the future has been arranged.

It is of the utmost importance that the building and general layout of the plant should be made as attractive in appearance as is possible.

Ample light and air should be provided about all working spaces within the building. Particular attention should be paid to ventilation, and it is suggested (though not required) that the air for combustion be drawn through ducts from the upper portions of the cell room and upper portions of the tipping room, thus controlling the flow of dust and smoke, and causing

air from outside the building to rush in, instead of allowing dust or smoke to escape to the outer air. In the proposed layout, it may be possible (though this provision is optional) to advantageously arrange a carcass chamber, whereby dead animals could be lowered through a port on the boiler room deck into a combustion chamber. A movable door or curtain should be placed over the hopper opening at the feeding level to control the dust. Ample room should be provided for the cleaning of all flues, dust settling chambers, boiler tubes, etc., so that the plant may be operated continuously six days each week, one day (Sunday) being allowed for cleaning.

Under the heading "Appurtenances," the contractor shall furnish tools for firing, clinkering, barrows for clinker removal, draught gauges for recording ash pit pressures, self-recording steam gauge or gauges, high temperature indicators sufficient to last for six tests of eight hours each, a continuous carbonic acid recorder of the gravimetric type, low water indicators or annunciators for boiler, thermometers for recording stack temperature, heated air and atmospheric temperatures, draught gauge for chimney, and such other appurtenances as are necessary to complete the installation, including injectors, feed water pumps, etc., for the boiler.

The following guarantees are required:

(a) The contractor shall guarantee that the residue from the furnace under ordinary conditions of operation shall be free of organic matter, thoroughly burned, hard and vitreous.

(b) That no nuisance shall be created in the ordinary operation of the plant.

(c) That neither odors, obnoxious gases, nor dust shall escape from the building or chimney.

(d) That at no time during the continuous operation of the plant shall the temperature of the combustion chamber or main flue fall below 1,250 degrees Fahr.

(e) That the flues, dust chambers and boiler setting shall be so arranged that the dust may be withdrawn after one day's cooling of the flues.

(f) The contractor shall guarantee and specify a minimum or a seasonal rate of evaporation ("from and at" 212 degrees Fahr.), and an amount of net useful steam per pound of refuse burned, either in pounds of steam per pound of refuse or as a percentage of efficiency of boiler and grate per pound of dry refuse, based upon the information given in the paragraph headed "Composition of Refuse."

(g) The contractor shall state the amount of material to be handled per fireman or stoker employed, per eight hour shift when high grade labor is used.

(h) The contractor shall guarantee to destroy refuse at the rate of 2.5 tons per hour when the material is such as is collected during the winter months shown by the tables in paragraph headed "Composition of Refuse."

Upon the completion of the destructor, and when it is ready for use in burning refuse, the contractor shall notify the superintendent thereof, in writing, and as soon thereafter as possible, a test run for a period of not less than two weeks under the joint supervision of the superintendent and contractor shall be made to determine the sufficiency of the contractor's guarantees. During the test run, the quality and quantity of refuse burned shall be varied to represent as closely as possible the seasonal differences in composition, volume and weight of the material, as indicated in the tables under "Composition of Refuse." If it should appear that the destructor is not meeting the requirements specified under "Guarantees," the contractor shall agree to make any changes necessary to carry out his part of the agreement. Should the contractor fail in meeting the essential requirements of the "Guarantees" concerning the creation of nuisances due to the operation of the furnace, the city may refuse to accept the destructor; in which event the contractor must remove from the city's land the destructor and its appurtenances.

As no decision has yet been made with regard to the utilization of steam power produced from the refuse, the contractor shall arrange a suitable blow-off for escaping steam. The boiler to be installed should be of ample capacity to utilize all heat generated.

The chimney will be of reinforced concrete, not less than 125 feet in height, of sufficient capacity for a plant burning 120 tons of refuse per 24 hours.

The refuse to be burned in the destructor consists of ashes, garbage and rubbish.

Ashes may be defined as the residue from fires in houses, schools, churches, stores, etc., and includes other inorganic materials such as glass, crockery, metallic substances, dirt, dust, earthenware, bricks, stones, etc. Anthracite coal is generally used in the West New Brighton district.

Garbage consists of organic wastes such as vegetable matter and animal matter with grease, water and slop.

Rubbish consists of wood, paper, rags, excelsior, straw, leather, rubber, etc.

The tables giving amounts and composition of the various wastes and refuse will eb considered later.

Explosion of Saratoga Septic Tank.

One of the septic tanks at Saratoga, N. Y., exploded some weeks since and at a recent dinner of the New England Waterworks Association, Prof. W. P. Mason, of the Department of Chemistry, Rensselaer Polytechnic Institute, Troy, N. Y., advanced the theory that the explosion might have been caused by the development of phosphine in the tank. Some criticism of this view has been made and in response to the editor's request for information in regard to the occurrence, Professor Mason has written a letter from which the following extracts are taken:

The point I made was this; some months ago I was standing upon the dock-line in New York City near a sewer outlet, and I observed bubbles of phosphine gas as large as teacups rising to the surface of the water and bursting into flame upon reaching the air. You will remember that spontaneous combustion is a characteristic of gaseous phosphine slightly associated with liquid phosphine. It would therefore look possible for phosphine to be formed from sewage decomposition products. And if this be so, in one place, it might readily be expected in another. I therefore offered it as a suggestion and possible explanation to account for the ignition of air and septic gases in the Saratoga septic tank. That the explosion was not that of a high explosive, as thought by some, was apparent upon inspection. The damage was uniformly distributed and was not localized as would have been the case had dynamite or something similar been the cause of the disaster. It is exceedingly difficult to understand how a smoker could have caused the ignition in midwinter, especially so, as there was no man on top of the tank at the time of the explosion. Had the ignition been caused by common-place human agency it is hard to say how to account for the material delay between the application of the match and the explosion of the tank. It is, of course, difficult to understand how the phosphine theory can be true in the face of the fact that we do not hear more frequently of such explosions. I offer the theory as a suggestion only and base it largely upon the observation in New York, cited above, and upon the difficulty in accounting for the delay which occurred between the application of the match and the explosion, if such a match be accounted the real cause. It is unnecessary for me to add that, even in the event of flame being applied from any source to the contents of the tank, no explosion would result if such contents were either too rich or too poor in combustible gases, or, in other words, if the admitted air were too small in quantity or if the tank were sufficiently ventilated.

Because a phenomenon has not been observed earlier is no indication that it has not occurred. Septic tanks are not numerous and favorable conditions for explosions are still less frequent of occurrence, and it is readily believeable that this was the first time the exact conditions occurred which would cause an explosion at the same time that a spontaneously combustible gas was generated in sufficient quantity to ignite the explosive mixture. Professor Mason's suggestion is evidently tentative and will undoubtedly lead to more careful investigation of the gases generated in septic tanks and to the insuring of such conditions of ventilation that an explosive mixture of gases and air will not be likely to occur.

MUNICIPAL PROBLEMS

Wilmington Parks—New York Merchants Association—Indiana Improvement Law—San Francisco Earthquake—Pasadena Public Works—Denver Lighting Franchise—Pipe Combination Prices—License Fee is Tax.

The Parks of Wilmington, Del.

The annual report of the Park Commissioners of Wilmington, Del., is always one of the finest examples of the printer's art which reaches MUNICIPAL ENGINEERING. It usually contains several views of the park system, showing the improvements which have been made. We are indebted to Mr. John M. Rogers, the artistic printer of the last report, through Mr. Edw. R. Mack, park engineer, for the views of the parks which are given herewith.

The first two views show the natural beauties of a stream through the park and the effect of a dam in improving the

appearance of the stream as it flows through the settled portion of the city. Another cut shows one of the park drives. The last two cuts show a stone seat and the beautiful view to be obtained from it, the latter view showing also the inscription on the back of the seat, which is a memorial to William Marriott Canby, the first president of the Board of Park Commissioners, serving from 1883 to 1904.

Work of the Merchants' Association of New York.

The Merchants' Association of New York has made a report of its recent work, showing the wide extent of its activities and influence. Following are some of the subjects covered:

Administration of Streets. Consequent upon numerous complaints from members as to the general disrepair of the streets, the Committee on City Conditions in 1905 made a thorough inspection of the streets of Manhattan south of 125th street, together with a careful study of the laws, ordinances and regulations relative to street maintenance, and suggested to the borough president several reforms in procedure which were in part adopted with great temporary improvement, but later abandoned. A second and even more comprehensive inspection was made in July, 1906, followed by a third inspection in November. The results of the latter inspections demonstrated conclusively that the conditions complained of were due to conflicting jurisdiction and defective procedure on the part of the several bureaus having control of the streets. It is the opinion of the Committee on City Elections that radical reorganization of the methods of street administration in this city is necessary to bring about better conditions. In accordance with that opinion a letter was addressed to the mayor, pointing out the difficulties. In part it was as follows:

It is a fact too obvious to admit of dispute, that the disrepair of our street pavements is so general and persistent as to cast great discredit upon the city, to impose a heavy burden of damage and inconvenience upon the business community, to entail great discomfort upon all citizens and to subject the public treasury to heavy loss, through judgments for damages. It is also indisputable that the streets are constantly and unduly obstructed by building operations. This condition is due to: (1) Failure promptly to repair the defects due to traffic; (2) inadequate control of restoration of opening in pavements made by (a) the water department, (b) the bureau of sewers, (c) gas, electric lighting, telephone and other public service corporations, (d) plumbers and others; (3) insufficient restriction of the use of streets for the storage of building material and for other purposes incident to the construction of buildings.

Great numbers of defects are due to the wear of traffic. These are seldom promptly repaired, and are frequently neglected for months, despite the fact that contracts for new pavements obligate the contractor constantly to maintain the pavements in serviceable condition for a period of five to ten years; the cost of such repairs being included in the original contract price, and thus being paid by the city whether the repairs are made or not. In practice, these maintenance contracts are not effectively enforced, and the contractors habitually neglect properly to comply with their obligations.

In the case of openings for sewers, water pipes, etc., the replacement of pavements is subject to conflicting jurisdiction and divided responsibility on the part of several co-ordinate branches of the city government.

The bureau of highways is legally charged with the restoration of pavements. In practice, the water department and the bureau of sewers prescribe the form of contract under which pavements removed by them shall be restored, and the terms are such as to preclude the enforcement of promptitude either by the branch in which the work originates, or by the bureau of highways.

In the case of openings made by public service corporations, plumbers, and others, repaving is done under general contracts made by the city The provisions of these contracts are not adapted to enforce promptitude. In other respects also, the administrative methods are defective, and much unnecessary delay in repaving results.

The occupation of the streets for building operations is frequently accompanied by extensive destruction of the pavements, not only immediately adjacent to the premises where building is in progress, but often extending across the entire street. This condition of disrepair is commonly maintained during a long period of time. Moreover, the occupation of the streets by building materials for building operations is usually unduly protracted and often abused, so that the public is needlessly deprived of the use of the streets, and subjected to the danger and inconvenience of long continued obstruction.

Stated broadly, the administrative conditions governing the branches of the public service to which we allude involve: (1) conflicting jurisdiction; (2) divided responsibility; (3) defective methods.

After due consideration the mayor assented to the request of the Committee on City Conditions and named the following commission to examine into and report upon the whole subject of street administration: John C. Eames, vice-president of the H. B. Claflin Co., and chairman Committee on City Conditions; Nelson P. Lewis, chief engineer, Board of Estimate and Apportionment; William C. Redfield, ex-commissioner of public works, Borough of Brooklyn; Samuel Whinery, C. E., author of "Municipal Works, Their Conception, Inception and Management," who has served as consulting engineer in certain matters for the department of docks, and the president of the Borough of Man-

hattan; Walter C. Kerr, president of Westinghouse, Church, Kerr & Co., engineers.

Street Numbers on Buildings. The Association co-operated with other civic bodies in causing the preparation of a new ordinance requiring all buildings to have their street number properly displayed.

Regulation of Pushcarts. The City Conditions Committee has taken advice of counsel upon this subject and is informed that the board of aldermen has no legal power to grant the use of streets for any purpose except transmission of traffic, and that licenses purporting to permit the carrying on of business in the street can not be sustained if opposed in court. The City Conditions Committee has recommended that steps be taken to abolish the sale of merchandise from pushcarts and to restrict this form of traffic to open spaces designated by the city.

Fire Alarm Service. Strong efforts have recently been made to secure the installation by the city of a new fire alarm service upon the lines recommended by the engineers of the New York Board of Fire Underwriters.

Perforation of Postage Stamps. The association communicated with the postal authorities of all the principal nations of the world, the result of its inquiry showing that in nearly all of them the postal regulations permit the perforation of stamps with firm's initials, and that this preventive of theft is largely used with beneficial results to merchants and no inconvenience to the postal administrations. This evidence has been submitted to the postmaster general, who now has the subject under advisement, with the probability of favorable action.

Backstamping of Envelopes. The association protested to the postmaster general and presented to him evidence showing the harmful results arising from the order abolishing the backstamping of envelopes, and requested its revocation. The subject is now under advisement by him.

Puenmatic Tube Service. The association presented to the postmaster general the reasons why the projected pneumatic tube service in New York city should be provided for, even though appropriations were too small to serve all cities. The contracts for this city have since been let and the work is now in progress.

Removal of Unused Car Tracks. There are upwards of twenty miles of car tracks in the Borough of Manhattan either not used at all or only in nominal use. After careful examination of the subject, the Committee on City Conditions has drafted a bill permitting the removal of unused street railway tracks upon the condition that the existing franchise rights of the companies to the use of such streets shall not thereby be affected and that, on the other hand, the effect of the act shall be to validate any questionable rights or confer new powers upon the companies.

Elevated Loop Connecting Bridges. The board of directors passed a resolution October 18, 1906, reaffirming its opposition to any additional elevated railroads in the streets of Manhattan; its opposition to the proposed elevated loop; and urging the construction of a subway connecting the several bridges and a system of loops in connection therewith, extending across Manhattan Island at several points, as laid out by the Rapid Transit Commission, as the means for most speedily and comprehensively ending the deplorable condition of congestion now existing at the Brooklyn bridge and adequately providing for traffic over both the Williamsburg bridge and the new Manhattan bridge now under construction.

Pollution of New York Waters. The discharge of sewage into the waters adjacent to this city is increasing with great rapidity, with the result that the waters are not only polluted to a degree that makes them offensive and unsightly, but extensive deposits of sewage matter constantly tend to obstruct the channels. A similar condition exists in other state waters. Generally, the present method of disposing of sewage presents a dangerous menace to public health. The association has therefore appointed a committee to deal with this subject composed of Edward Hatch, Jr., J. Pierpont Morgan, Albert Vander Veer, M. D., Geo. C. Whipple, C. E., John Y. Culyer, C. E. This committee is actively maturing plans for causing the adoption of modern and effective methods for disposing of sewage without contamination of public waters.

Niagara Falls Preservation. Several Canadian and American power companies having made application to the secretary of war for permits to transmit into the United States electricity generated by the waters of Niagara river, to the extent of 160,000 to 350,000 horsepower, the association, through its counsel, Hon. John W. Griggs, has appeared in opposition. At the hearing this association contended that the prime intent of the act approved in June last was to preserve the scenic grandeur of Niagara Falls; that the diversions contemplated by the desired permits would seriously affect the appear-

ance of the falls; that the secondary purpose of the act was to promote a treaty with Great Britain whereby the diversion of waters should be definitely limited and that any rights of existing companies would be of necessity provided for by such treaty and therefore that no considerations of equity demanded that the secretary should grant the permits asked for. The secretary still has the matter under advisement.

Regarding the Earthquake at San Francisco.

BY L. J. LE CONTE, M. AM. W. W. ASSOC.

The writer thought that the physical data connected with this great calamity and its all important bearing upon the water supply of the city of San Francisco would furnish a most interesting subject for discussion. The writer does not pretend to know all about the facts, because they have not come to light as yet, but only such as have been well ascertained up to the present time.

As a result of the quake a great fissure was developed, extending, as far as known, from Point Arena on the north nearly to Point San Luis on the south—covering a distance of some 300 miles. This fissure can be clearly traced all the way throughout this course. At the northerly end of the fissure there is evidence to show that the slip was fully fifteen feet. At the Spring Valley reservoir, near San Mateo, the slip was fully 8.0 to 8.5 feet, and progressively less as we advance southerly. The fissure strikes the coast-line at Point Arena, thence up Gualala river, and thence along the axis of Tomales bay to Bolinas, thence across the entrance to the Golden Gate to Mussel Rock, thence along the Chain of Lakes made by the Spring Valley waterworks, San Andreas, Crystal Springs, Searsville lake, Portola, etc., down to Chittenden and Pajaro valley to the Salinas river, and up the Salinas river as far as the vicinity of Paso Robles. Beyond this point it has not been traced with certainty, but it probably goes into the ocean near Port San Luis.

This quake lasted for twenty-eight seconds by seismograph record. It was the severest shock experienced by Californians since the earliest record, and the mechanical effects are quite remarkable.

One of the most vital effects was the entire cutting off of the city water supply, by which the fire department was robbed of all its usefulness, when the general conflagration set in, shortly after the quake. Fires broke out at fifty different places all over the city and rapidly spread so as to baffle all the fruitless efforts of the dynamiters who were wrecking buildings, trying to check the progress of the fire.

The three supply mains leading to the city were completely wrecked, thus cutting off all new supply. The large distributing mains within the city limits were torn asunder and the local service reservoirs, in spite of all efforts, emptied themselves in twelve hours after the quake, leaving the city without a drop of water to fight the fire with. The large emergency reservoir, Lake Merced, situated in the city limits, was put into service as soon as possible, but too late to be of any service, and a limited supply of water was furnished to the unburnt district.

It seems to be quite clear now that the present distributing system of pipes in the city will have to be materially changed in order to meet the quake requirements as near as possible.

In looking over the wreckage and ruins one is much struck by the marked difference in the physical effects of the quake on the high solid ground and on the low and made land. On the latter the destructive effects were very severe. The lesson to be learned from the quake is that the large distributing mains within the city limits must be laid on the solid high ground, where the shock is much less pronounced, and that the smaller distributing mains should then lead down into the low lying and made ground. This rule should also apply to the supply mains leading to the city, which can just as well be kept up on the high solid ground, where they will be largely out of danger. Furthermore, the city should use all the high hill tops for emergency reservoir sites, which could be made ornamental and ought not to detract in the least from the beauty of the parks. In case of another break in the supply mains these local reservoirs would come in very handy when most needed.

In the made land district, near Eighteenth and Howard streets, the large distributing mains, as a precaution, were made of wrought iron with bell joints of cast iron, at short intervals. After the quake all of this pipe was in good condition except where the ground displacement was greatest, at which point the pipe was torn asunder.

This quake has clearly demonstrated the great value of wrought iron pipe to stand the convulsive strains brought about by the earthquake shocks.

The Pilarcitos supply main, wrought

*Given at the Convention of the American Waterworks Association.

iron riveted pipe, unfortunately lies right on the line of the fissure, and of course, is badly wrecked for 3,000 feet—pulled apart forty inches in places, and telescoped in other places—showing great local distortion of the ground. The fences in this neighborhood seem to show a slip of 7 to 8.5 feet. There seems to be some grave doubts about the advisability of ever rebuilding this pipe line. The location of the pipe line will have to be entirely changed to some other site, involving the probable expense of some $400,000 to $500,000, and it is highly probable for this reason that some other line may be used instead. Owing to the terrible financial straits into which the Spring Valley Water Co. has now been suddenly precipitated, some such policy will have to be adopted. In addition to the enormous expense to which the water company has been subjected by reason of the earthquake damage and fire losses, they will also suffer a still greater loss of at least 50 per cent. or more in monthly income, which is now entirely wiped out by the destruction of the city. In its hour of trouble they should justly be entitled to their share of public sympathy.

Amendments to Indiana Public Improvement Law.

A Barrett law amendment is favored by Thomas A. Daily, who will, as a member of the Indiana general assembly, do all he can to have the worst features of the law eliminated. He says this law for the collection of street and improvement assessments works injustice in innumerable instances and should be amended.

Mr. Daily says:

It is not an uncommon thing for a person who is assessed a small amount for a sewer that is built in his neighborhood, but not in his street, and who fails to receive notice of the assessment, to find himself compelled in court to pay heavy costs and attorney's fees for the collection of the trivial original amount. Say, for instance, he is assessed and the postal card notice does not reach him. He does not pay and suit is brought, probably by some bond buyer, who holds the Barrett law bonds. Under the present law if one does not pay the first of the ten yearly instalments judgment can then be obtained against him for the entire amount. When he pays this with court costs and attorney's fees he has paid ten or twenty times the amount originally due from him.

Of course, notice of the suit is given by publication, but the man who is sued is usually the man least likely to see the publication, and is least able to afford the heavy costs. For the publication in the three newspapers, too, another charge of $5 each is added to the costs.

I believe that before any suit is brought under the Barrett law the bond holder should be compelled to give ten days' written notice to the property owner of his intention to foreclose the lien, and that in no case should the attorney's fee exceed 50 per cent. of the amount of the assessment. In case the proper owner's address is unknown so that notice can not be served, no attorney's fee should be recoverable.

In a case where the assessment is only 50 cents or so, the attorney getting 50 per cent. of this would not get much of a fee, but most of these suits are brought with several defendants grouped, and the attorneys usually collect $5 fees for each defendant. This is manifestly unjust and the proposition to limit their remuneration might be a real protection to the poor people who are sued.

Public Works in Pasadena.*

BY T. D. ALLIN, CITY ENGINEER, PASADENA, CAL.

The population of Pasadena is now 25,000, which has increased 3,500 during the past year, with an average increase per year of 3,000 during the past three years.

The city's area is 11.4 square miles, making the expense for street maintenance and lighting very heavy compared with its population. The tax rate for general purposes is limited to $1.00 per $100.00 valuation and the bonded indebtedness other than for school purposes is only $322,000.00.

Contracts have been let for 2.34 miles of asphalt paving and work has been ordered on 3.38 miles more, which when completed will give the city a total of 11.6 miles of asphalt paving. This work is costing from 18½ to 19 cents per square foot for 4-inch cement concrete base, 1-inch binder and 2-inch surface.

The surface of all macadam constructed during the past year has been treated with crude oil. 1.35 miles additional of this class of work has been ordered. From 1¼ to 1½ gallons per square yard of crude oil heavy in asphaltum is applied to the surface and the work complete is costing 7¾ cents per square foot. This class of work has proven very successful in Riverside, Cal., and it is believed that it will prove satisfactory in Pasadena for residence streets.

Contracts have been let and work is being done on 15 miles of street oiling, the crude oil being applied to the natural surface and 10 miles additional of the same class of work has been ordered.

This class of work is done by bringing the natural soil to an even surface and then applying 1 gallon per yard of crude oil, heavy in asphaltum, then a coat of clean, sharp sand or rock screenings is applied and then another application of

*From a paper before the American Society of Municipal Improveemnts.

crude oil of about ½ gallon per yard is made, regulating the quantity of oil applied by the needs to thoroughly wet the sand and yet not leave the surface sloppy. The street is then thoroughly rolled with a 6 ton roller. This class of work costs from 1 to 1¼ cents per square foot and is very satisfactory for out-lying residence streets where traffic is comparatively light.

This last class of work is very general in southern California towns and cities and is very satisfactory considering its cost. When condemned, it is generally by persons expecting as enduring work as can be done for many times its cost. The general difficulties encountered with this class of work, and the same also applies to a limited degree to macadam with oiled surface, is that it does not receive proper maintenance. After construction it is too often left to take care of itself and the dear public wonders why it does not last equally well with asphaltum or brick pavements.

Oil as applied to country roads is usually of a still cheaper application, only the main thoroughfares being treated in the more thorough way; except on main thoroughfares the main object being to allay the dust without an attempt to create an asphaltum surface. Many hundreds of miles of country roads in California have been made a pleasure to drive over when, were it not for the oil, they would be almost beyond endurance on account of dust during our long dry summers.

Another class of oiled streets now being constructed and which promises to be very satisfactory, is constructed by plowing up the street to a depth of six or seven inches and then working the oil to the bottom of the plowing by means of a spiked roller. Oil is added from time to time and the roller run over the same surface hundreds of times, causing the oil to be forced down into the plowing and become incorporated with the earth from bottom to top, with both oil and earth thoroughly tamped by the constant rolling into one compact mass. In all, approximately three gallons of oil per square yard are used with the cost of the work varying from two to three cents per square foot. About ¼ mile of this class of work has recently been completed in Pasadena, a part of which work is exposed to heavy teaming, putting it to a very severe test. This street is being watched with much interest, as many believe that it cannot long withstand such heavy loads.

In all classes of street oiling the oil is, or should be applied hot, 200 degrees usually being the temperature. Upon a large percentage of country roads the oil is applied cold on account of the lack of facilities for heating. When hot, the oil penetrates much more quickly, therefore incorporates with the earth or sand more readily and meets with much less complaint from the traveling public for the first few days after it is applied. In treating city streets one side of the street should be and usually is treated at a time, permitting traffic to keep off of the fresh oil until all wetness is absorbed by the natural soil, or the sand application as the case may be.

For the average residence streets the writer believes the macadam base with oiled surface to be the most nearly ideal street yet constructed in California. The macadam forms a hard, unyielding base, while the oil, or more truly speaking, the asphaltum, as the oil contains 85 per cent. D grade asphaltum, mixed with sand, forms the carpet or wearing surface, which surface should be as thin as possible to prevent sponginess and yet thick enough to fully protect the macadam. The sand in the asphaltum produces the wearing qualities and the asphaltum provides the cementing qualities which bind the sand together, forming an asphaltum paved street of cheap construction, which is noiseless and also dustless with proper maintenance.

Such streets, however, require more attention than asphaltum paved streets and should not be left to take care of themselves.

Water Works—Private. Water is supplied to Pasadena by three private companies, covering separate territories. Water is plentiful for present needs and is excellent in quality. The rates are low and the entire domestic service is metered.

One company has just completed a seven million gallon cement lined reservoir. New pipe lines and meters are being added to keep up with the growth of the city. More extensive improvements would be made were negotiations to sell to the city entirely abandoned.

In March, 1905, Pasadena voted $931,250.00 for the purpose of purchasing the three water plants and for extensions. Antagonistic city officials were elected a week later. Technical difficulties arose. Suits were brought, but court decisions so far have been favorable to the transfer of the plants to the city. When the city will acquire the plants is problematic, as the companies are no longer under legal obligation to sell even should the present administration change its attitude, which is not likely, and endeavor to purchase.

The people are strongly in favor of ac-

quiring the existing plants but are resigned to the necessity of awaiting the advent of a new administration with the additional delays incident to new negotiations with the water companies.

Fire Protection. The city voted $75,000.00 in May last for fire protection, including the purchase of three lots and erecting thereon three fire houses, enlarging the present houses and for equipments.

Lighting Plant—Private. Some eight months ago a dispute arose between the officers of the private lighting plant and the city council when the city officials claimed the company was not furnishing the quantity of electrical energy for which it was being charged. The dispute went so far that the city called a bond election to vote $125,000.00 to establish a municipal plant, which carried. Soon thereafter the lighting company claimed a defect in the proceedings and got an injunction to prevent the sale of the bonds. The matter is still in court. The city determined to have a plant of its own, raised the tax levy 18 cents per $100.00 ($30,000,000, assessed valuation) and is going ahead with the municipal plant as far as the money so raised will go.

Garbage Disposal. The garbage is hauled by private parties onto vacant lands and burned, a method becoming entirely unsatisfactory. The city owns land for the purpose and an incinerator will no doubt be erected in the near future.

Public Schools. $100,000 was voted in the early summer for more grounds and school buildings. Four new buildings are being constructed, ranging from four to twelve rooms each, in addition to the enlargement of other buildings.

Denver Lighting Company's Franchise Approved.

Judge Peter L. Palmer rendered an opinion, December 10, in the quo warranto suit instituted to test the title of the Denver Gas and Electric Company to the twenty-year franchise, which, on the face of the returns, was approved by the qualified taxpaying electors at the municipal election held on May 15. Judge Palmer held that any voter who owned property subject to assessment, whether assessed or not, was a "qualified taxpaying elector," and as such was entitled to vote on the franchise. Judge Palmer entered judgment for the light company. Notice of appeal to the supreme court has been given by the state.

Damages for Combination Raising Pipe Prices.

The United States supreme court rendered a decision, December 3, in the case of the Chattanooga Foundry and Pipe Works and South Pittsburg Pipe Company vs. the city of Atlanta, Ga. The case came to the United States court in pursuance of an effort by the pipe manufacturers to secure the reversal of a decision handed down by the circuit court of appeals, which was unfavorable to them. The suit was instituted by the city of Atlanta under the Sherman anti-trust law, on the complaint that by the combination of the manufacturers the municipality had been compelled to pay an excess of $15,000 over a fair price on orders for pipe amounting to $56,000. The city asked damages in the sum of $45,000, or three times the amount of loss. Affirming a decision of the circuit court for East Tennessee, however, the United States supreme court allowed only $7,000.

A License Fee is a Tax.

The United States supreme court has rendered a decision holding that a license fee is a tax and finding in favor of the state of New Jersey against the Cosmopolitan Power Company of that state. The decision is said to be of vast importance in many states and to numerous corporations which have held that they are immune from annual tax on their capital stock.

The suit grew out of a controversy over taxes due New Jersey on the company's franchise for the years 1902 and 1903, and also involved the question as to whether taxes should be given a preference over other debts where the debtor is insolvent. The case was tried in the United States circuit court, which allowed $4,943 and the verdict was affirmed by the circuit court of appeals. The state claimed $9,254 and appealed the case. The opinion handed down by Judge Day, of the United States supreme court, was favorable to the state. The decision of the court of appeals was reversed on the ground that under the bankrupt law state taxes should be given the preferences.

MUNICIPAL AND TECHNICAL LITERATURE.

New Publications.

Engineering Works in Towns and Small Cities. By Ernest McCullough. 530 pp. Cloth, $3. Technical Book Agency, Chicago, Ill.

The first chapter of this book is styled an extended preface and states the classes of men for whom the book is written, engineers and city officials in cities and towns of less than 20,000 population; the author's qualifications for writing the book, viz., service in town engineering and contractor's engineering capacities in many towns and cities, large and small; the need for such a book as this on account of the lack of education and good experience among the engineers and the council committees having charge of public improvements in the smaller municipalities; and the principles upon which the city engineer should be selected, including an ordinance governing the office and the appointment of the incumbent.

The book is written out of the author's own experience and it contains little which he has not direct personal knowledge about. Fortunately his experience has been varied, his observation has been keen and his judgment is excellent and the result is a practical book of great value, not only to the classes of city officials for which it is primarily designed, but to young engineers who expect to devote themselves to construction work, and to contractors.

At the beginning, the author's purpose seems to be to supply the detail and the practical instruction which is lacking in most of the books treating the various subjects covered, and he frequently refers the reader to books upon special subjects for further information and for the theoretical discussions. He succeeds, however, in making a book which is very fairly complete in itself, although the amount of space devoted to some subjects is comparatively small.

The chapter on "Roads and Streets" contains less than ten pages, apparently intended for the reading of the average city official, without engineering knowledge, but it is followed by a chapter on "Walks, Curbs and Gutters" with nine pages, and two on "Street Pavements" with twenty-four pages, and large parts of the chapters on "Contracts and Specifications," "City Engineers' Records," "Field Work" and "Engineering Data" are devoted to street work. The same statement aplies to the chapters on "Sanitation," "Drainage" and "Sewerage," which together occupy thirty-six pages and to that on "Water Supply," which occupies fifteen pages. "Concrete" has a chapter of its own of twenty-eight pages and the "Building Department" has eleven pages. "Miscellaneous Data" fill twenty pages and "Contracts and Specifications" about seventy pages. The chapters on "Office Systems," "City Engineers' Records" and "Field Work" will be particularly interesting to city engineers in the smaller cities who seldom have any system in these matters and are greatly in need of it.

The last chapter on "Engineering Data" departs somewhat from the plan of the remainder of the book and contains short and fragmentary treatments of various subjects which are more fully treated in excellent books upon the specialties touched upon. The chapter will hardly serve in place of these treatises, and in some cases will discourage the engineer reading it from further effort to understand the subjects considered, while in other cases it will induce him to go to the sources from which he can obtain the knowledge which he has found from the reading of this chapter that he needs. The manner in which tables are inserted in the text without reference to the context is peculiar and detracts from the convenience of their use. To the writer this chapter seems somewhat out of place in this book.

The appendices are largely devoted to advertising and, while they contain some excellent reports of the author's practical experience, lose their force largely on account of the restriction of the treatment to certain materials and machinery.

A good index of nearly eleven pages closes the volume.

The author is not a professional bookmaker, although his experience in preparing three or four little books on subjects included in this one has helped him in preparing it. He has not employed an expert book manufacturer to put his manuscript into print and the first feeling of the engineer who receives the book will be one of disappointment, which may continue while he runs over the leaves, but when he sits down to read it thoroughly,

and especially when he comes back to it for answers to his many questions about practical methods of doing work, he will find that the dress is no indication of the value of the contents and he will soon find the book well nigh indispensable. The reviewer's experience with the "Question Department" of MUNICIPAL ENGINEERING demonstrates the need for such a book as this. It answers nearly all the questions regarding details of the city engineer's work which have been asked and the book will undoubtedly be referred to frequently in that department in the future. Doubtless one reason the reviewer believes the author has good judgment is because the questions referred to would find answers in the book agreeing with those which have offered in this magazine.

The Elements of Taxation. A popular historical and general discussion of the different methods of levying and collecting taxes, with reasons for and against; the shifting and incidence of taxes; things that are taxed, things that should be, and things that should not be taxed, etc., ending with the ideal tax system. By Newton M. Taylor. Equity series. Paper, 168 pp. 25 cents. C. F. Taylor, 1520 Chestnut St., Philadelphia, Pa.

The author has given an interesting monograph upon the portions of the subject of taxation named in the sub-title. Under things taxable he touches briefly upon taxes on land, labor, personal property, polls, bachelors, transactions and commodities, transportation, occupations, franchises, good will, shipping, money, money obligations, life insurance, some miscellaneous items and also tolls. Income and inheritance taxes have each a separate chapter.

Methods of taxation include direct and indirect methods such as government monopolies, the general property and the single tax, fines, fees, assessments, tariff, bounties, export taxes, lotteries, proportional, progressive, regressive, digressive and double taxation, and the shifting and incidence of taxation.

The fundamental rules of taxation are briefly stated and methods of levy and collection are described, the method of taxing corporations being more fully stated, and taxation of railroad and banking corporations in still more detail.

The characters of taxation usual for federal, state and local purposes, methods of fixing rates, appraisements and collection require two chapters. Exemptions by constitutional provisions, by state laws and by local ordinances to various organizations, classes, corporations and individuals and of debts and mortgages are well shown.

The author sets forth in the concluding chapters his ideal of a system of taxation. He assigns to the federal government tariff and internal revenue taxes, although he believes the former should ultimately be abolished and the trades producing the latter should be abolished. He indicates other federal taxes now imposed which should be abolished or reduced. He favors a federal taxation of incomes, inheritances, corporation credits, real estate, mortgages, sale of real estate, stock exchange transactions, persons, large corporations. He considers that some of the proceeds of many of these taxes should be applied to local benefits and would therefore have the government distribute what is in excess of its own needs among the local taxing districts in some equitable manner, part of them, at least, according to population. Education, highways and bridges are the principal objects to which he would devote the amounts so distributed. In addition to the local taxation of all real estate, and tangible and intangible personal property, he would impose taxes on good will, polls, and franchises, and has eight classes of exemptions from taxation, most of them coming under a general exemption from taxation of all estates of whatever kind less than $5,000.

Whatever the opinion may be regarding the theoretical conclusions of the author the historical and descriptive portion of the book gives an interesting and instructive view of the general subject of taxation which will clear up the minds of many of those who read it.

Tables and Other Data for Engineers and Business Men. Compiled by Chas. E. Ferris, B. S. Sixth edition. 242 pp., leather, 50 cents. University of Tennessee Press, Knoxville, Tenn.

The fact that this is the sixth edition within less than as many years is evidence of the popularity of this pocket book, which was originally issued largely as an advertisement for the University of Tennessee. It has been enlarged and improved until it contains a large proportion of the ordinary tables needed by the engineer in mensuration, transformations of numbers and dimensions, weights, areas, trigonometrical functions, logarithms, strength and resistance of materials, properties of steam, air, water, fuel and other materials, earthwork, electrical currents, interest, etc.

ORGANIZATIONS AND INDIVIDUALS

National Association of Cement Users—Northwest Cement Products Association—Iowa Cement Users—Indiana Engineering Society—Technical Meetings—Civil Service Examinations—Personal Notes.

National Association of Cement Users.

The third convention of the National Association of Cement Users will be held Jan. 7 to 12, inclusive, in Chicago. The exhibits will be in a building variously described in the circulars distributed as Tattersall's, at Dearborn and Twelfth streets, and the Seventh Regiment Armory. The hall will be open to visitors between 10 a. m. and 11 p. m., from noon of the 7th to noon of the 12th. No sessions of the convention will be held during the afternoons so that the attendants will have full opportunity to visit the exhibition hall. There will be no session on Thursday night and visitors will have their choice of entertainment or exhibits on that night.

Reduced railroad rates by the certificate plan are arranged for.

The program of the convention is partially arranged to occupy the remaining time during the week. The official circular gives the following titles of papers:

"Cement Sidewalks," by Albert Moyer, New York City.

Report of Committee on Streets, Sidewalks and Floors, by Geo. L. Stanley, chairman, Ashtabula, Ohio.

President's Address.

"Reinforced Concrete," by Prof. W. K. Hatt, Purdue University, Lafayette, Ind.

"Forms of Concrete Construction," by Sanford E. Thompson, cons. engr., Newton Highlands, Mass.

"Simple Tests for Determining Value of Materials for Use in Mortar and Concrete," by Wm. B. Fuller, cons. engr., New York.

Report of Committee on Testing Cement and Cement Products, by E. S. Larned, chairman, Boston, Mass.

"Artistic Use of Concrete," by A. O. Elzner, architect, Cincinnati, Ohio.

"Finish for Concrete Surfaces," by H. H. Quimby, engineer of bridges, Philadelphia, Pa.

"Treatment of Concrete Surfaces," by Linn White, chief engineer South Park System, Chicago.

Report of Committee on Art and Architecture, by Chas. D. Watson, chairman, Toronto, Canada.

"Concrete Blocks," by H. H. Rice, Denver, Colo.

Report of Committee on Concrete Blocks and Cement Products, by M. S. Daniels, chairman, Suffern, N. Y.

Discussion by Spencer B. Newberry, Sandusky, Ohio.

Report of Committee on Machinery for Cement Users, by J. F. Angell, chairman, Columbus, Ohio.

"Waterproofing," by H. Weiderhold, Philadelphia, Pa., Edward DeKnight, New York City, J. W. Fish, Sandusky, Ohio, G. G. Fry, Indianapolis, Ind., S. J. Binswanger, Chicago, Ill.

Report of Committee on Fireproofing and Insurance, by E. T. Cairns, chairman, New York City.

Report of Committee on Laws and Ordinances, by H. C. Henley, chairman, St. Louis, Mo.

The convention will be formally opened at 10 a. m., Tuesday, in the banquet hall of the Auditorium Hotel, more than a mile from the exhibit hall, and the election of officers will take place at some time during Wednesday morning. The excursion to a cement plant and the "Chicago Night" of the earlier circulars are not mentioned in the latest program received.

Membership in the Association costs $5. A convention membership costs $2, and single admissions to the exhibit hall cost 25 cents.

The circular from which the above is taken is assumed to be official, although it is anonymous, names of officers and their addresses being omitted entirely. W. W. Curtis, of Chicago, is the secretary.

Northwest Cement Products Association.

The convention of the Northwest Cement Products Association will be held at St. Paul, Minn., January 16, 17 and 18, in the new $350,000 auditorium, the use of which has been given by the city and the Commercial Club. Reduced rates—one and one-third fare—have been granted by the Western Passenger Association on the usual certificate plan. Hotels make a special cut rate to wearers of membership badges.

The association extends an invitation to all architects, especially those of the

Northwest, to submit photographs and drawings of notable work which they have done in cement or concrete of any character, to be prominently exhiibted at the convention.

C. A. P. Turner, Minneapolis, is president of the association, and Martin T. Roche, 410 Pioneer Press Bldg., St. Paul, is the secretary.

Iowa Association of Cement Users.

The third annual convention of the Iowa Association of Cement Users will be held at the Iowa State College Jan. 23, 24 and 25, following the National convention in Chicago and the Northwestern in Minneapolis.

The exhibits of cements, cement products and cement using machinery will be a feature of the meeting. Space is provided without charge in the convention hall and the new college forge shop.

It is planned to have prepared a series of standard sands with which those in actual use may be compared. Those attending the convention are urged to bring samples of both the raw materials and finished products for comparison and display. Practical methods of testing the setting of cements, breaking strength and other properties will likewise be demonstrated at the convention.

Arrangements are making for reduced rates on railroads and for the satisfactory entertainment of visitors, a larger number on and near the college campus than in former years. Ira A. Williams, Ames, Iowa, is secretary.

Indiana Engineering Society.

The Indiana Engineering Society will meet in the Commercial Club rooms, Indianapolis, on Jan. 17, 18 and 19. The program as thus far announced will include the following:

"The Design of a Successful Gasoline Engine," with stereopticon, by L. O. Danse, of the Atlas Engine Works, Indianapolis.

A talk upon "The Chronological Development of the Stone Arch," with stereopticon, by Prof. M. A. Howe, Rose Polytechnic Institute.

"A Reinforced Concrete Sewer," by M. A. Morris, assistant city engineer, South Bend.

"Paving Between Street Car Tracks and Rails," by B. J. T. Jeup, civil engineer, Indianapolis.

A discussion of "Some Engineering Problems in the Design of a Wood Working Plant," by W. J. Rickey, of the Singer Manufacturing Co., South Bend.

"Estimates for Steel Highway Bridges," by B. F. Nesbit, chief engineer of the Vincennes Bridge Co.

An illustrated talk on "The Kankakee Drainage," by M. H. Downey, city engineer of Anderson.

The Committee on Railroads will have a report, presented by its chairman, Prof. H. O. Garman, Purdue University.

"Interurban Railway Engineering," by R. P. Woods, chief engineer Indianapolis and Western Road.

"Advantages of Electrical Inspection," by F. R. Daniel, chief state inspector for the insurance organizations.

A joint paper on "The Track Elevation Plans for Indianapolis," by Chas. C. Brown and B. J. T. Jeup, formerly city engineers, and J. W. Stearns, formerly assistant in charge of track elevation.

"Electric Car Braking," by Prof. H. T. Plumb, Purdue University.

"Principles of the Telephone," by Prof. Arthur Bessey Smith, Purdue University.

An explanation of the Work of the State Railroad Commission, by Union B. Hunt, chairman.

"Design and Construction of an Asphalt Paving Plant," by Chas. Brossmann, Jr.

"Some Tests of a Mercury Vapor Lamp," by Prof. A. N. Topping.

"Unit Stresses for Designing Timber Structures," by Prof. W. K. Hatt.

"The Recovery of Steel and Iron from Overstrain," by Prof. E. L. Hancock, Purdue University.

A report on an Illinois drainage problem, by G. C. Houston.

An Indiana drainage problem, by L. S. Alter.

"Softening of Water for Boiler purposes," by W. S. Collins.

Papers are promised by S. H. Knight and Prof. W. F. M. Goss.

D. V. Moore will furnish a discussion of the design of reinforced concrete structures.

The Committee on Waterworks will present a compilation of waterworks statistics.

The Committee on Stream Pollution will consider a law for the protection of streams.

Technical Meetings.

The twenty-sixth annual convention of the Iowa Brick and Tile Association will be held at Sioux City, Ia., January 9 and 10.

The ninth annual meeting of the American Ceramic Society will be held at St. Louis, Mo., February 5 and 6.

Teh twenty-first annual convention of the National Brick Manufacturers' Association will be held at St. Louis, Mo., February 4 to 16. John R. Copeland, president executive committee; Theo. A. Randall, secretary.

The annual meeting of the Illinois Society of Engineers and Surveyors will be held at Peoria, Ill., commencing January 23.

The annual meeting of the Engineers' Society of Western Pennsylvania will be held at Pittsburg, Pa., January 3. F. V. McMullin, secretary, 410 Pennsylvania avenue, Pittsburg.

The annual convention of the Michigan Engineering Society will be held at Detroit, Mich., January 8. F. Hodgman, secretary, Climax, Mich.

The annual meeting of the New Eng-

land Water Works Association will be held at Boston, Mass., January 8. Willard Kent, Narragansett Pier, R. I.

The annual meeting of the American Society of Civil Engineers will be held in New York City, January 16 and 17. C. W. Hunt, secretary, 220 West Fifty-seventh street.

The annual meeting of the Engineers' Club of Philadelphia will be held January 19. Walter Loring Webb, secretary, 1122 Guard street.

The annual meeting of the Canadian Society of Civil Engineers will be held at Montreal, January 29. Prof. C. H. McLeod, secretary, 877 Dorchester street.

The annual meeting of the New England Gas Association will be held at Boston, Mass., February 21. N. W. Gifford, secretary, East Boston.

The annual meeting of the Association of Ontario Land Surveyors will be held at Toronto, February 26. Killaly Gamble, secretary, 405 Temple Bldg., Toronto, Ont.

The Engineering Society of the South held its annual convention in Atlanta, Ga., December 14 and 15. Officers were elected as follows: President, A. V. Gude, of Atlanta; vice-presidents, Granberry Jackson and G. H. Harris, of Birmingham, and R. M. Clayton, of Atlanta; secretary and treasurer, H. M. Jones, of Nashville; directors, G. M. Inglis and C B. Wilson, of Nashville.

U. S. Civil Service Examinations.

Examinations will be held by the U. S. Civil Service Commission at the usual places as follows:

For civil engineer in the Philippine service at $1,400, and probable early promotion, on January 3 and 4.

For aids in the U. S. Coast Survey, at $720, and possible advancement at once if competent, to computer at $1,400 to $1,800, and draftsmen at $1,400 to $1,800 according to experience of candidate. There has been difficulty in filling these positions and applications are specially desired. Jauary 3 and 4.

For laboratory assistant in chemistry in the Bureau of Standards, in particular for work in polariscope section of sugar testing work, at $900 to $1,000. Jan. 4.

For architectural and structural steel draftsmen in office of San Francisco light house district, at $125 a month. January 9 and 10.

For computer in the U. S. Coast and Geodetic Survey, at $1,000; computer at Manila, P. I., at $1,400 to $1,800, and draftsmen at Manila at $1,400 to $1,800, according to experience of candidate. January 9 and 10. The last examination for these positions secured no eligibles, so applications are specially desired.

For three topographic and cartographic draftsmen in office of chief of staff, War Department, at $1,000. January 9 and 10. The last examination for this place failed also.

For at least two mechanical draftsmen at arsenals and depots at Augusta, Ga., Benicia, Cal., Philadelphia, Pa., Manila, P. I., Governor's Island, New York City, Washington, D. C., Rock Island, Ill., San Antonio, Tex., Fort Hancock, N. J., Springfield, Mass., Dover, N. J., Watertown, Mass., Watervliet, N. Y.

Personal Notes.

W. E. Martin has been elected city engineer at Shreveport, La.

Edward D. Rich has resigned as city engineer of Summit, N. J.

W. A. Griesbach has been elected mayor at Edmonton, Alta, Canada.

Hon. John McKinley, mayor of St. Johns, Mich., died of burns received in a gasoline explosion December 10.

M. H. Blivins has been appointed superintendent of the Niagara Falls Water Co., to succeed J. H. Ince, resigned.

Dr. William Cunningham, health officer and former mayor of Bay City, Mich., died of heart disease December 5.

M. D. Mills has been elected mayor and R. Herbert, H. H. Crawford and W. Rankin councilors at Strathcona, Canada.

H. H. Crowell, of Syracuse, N. Y., has been appointed technical expert of the New York Gas and Electric Commission.

Lorenzo M. Taylor, city surveyor of Utica, N. Y., from 1838 to 1849, died in that city recently in his eighty-seventh year.

A. Serboni, city engineer of Narikaping, Sweden, is visiting American cities for the purpose of studying municipal works.

G. H. McAvery has been elected mayor and D. Simmons, W. J. Foster and J. H. Harvey councilors at Fort Saskatchewan, Canada.

Alvain Swan, Jr., will be appointed city engineer at Trenton, N. J., to succeed C. C. Haven, who has declined another term.

J. W. Cable, of Toledo, Ohio, has been appointed secretary of the State Board of Public Works, to succeed William E. Thompson, resigned.

Capt. J. F. LeBaron, M. Am. Soc. C. E., has been appointed president of a commission to study and report on the hydroelectric powers of Nicaragua, C. A.

F. F. Weld has severed his connection with the Trussed Concrete Steel Co. of Detroit, to become engineer of the Reinforced Concrete Construction Co. of Pittsburg.

Hon. Charles Hyman, who resigned the portfolio of the minister of public works of the Dominion of Canada and also his seat for London, has been requested to reconsider his action.

Guy L. Smith has been elected mayor and S. B. White, I. N. Boring, E. C. Baldwin, W. B. Harrison, B. M. Alfred, Geo. Barrows, P. H. Wofford and J. W. Cass alderman at Johnson City, Tenn.

Bion J. Arnold, consulting engineer, Chicago, Ill., is reported to have been appointed to look after Chicago's interests in traction matters at a salary reported in the daily press as $35,000 a year.

Lawson Purdy, for ten years secretary of the New York Tax Reform Association, has been appointed president of the Department of Taxes and Assessments of the city of New York.

Clarence D. Pollock, of the Highway Department, Brooklyn, has been elected president of the Brooklyn Engineers' Club. Joseph Strachan, of the Sewer Department, has been re-elected secretary.

Frank G. Baum, M. Am. Inst. E. E., has resigned his position with the California Gas and Electric Co., of San Francisco, and will open offices in the Chronicle Bldg., San Francisco, as consulting engineer, giving special attention to hydro-electric power plants and long distance transmission systems.

Mr. James Broden, vice-president of the Republic Creosoting Company, of Indianapolis, Ind., died at Mobile, Ala., December 23, after a four days' illness. Mr. Broden left Indianapolis December 17 on a business trip to the South, apparently in perfect health, and his death was a great shock to his many friends. Mr. Broden was forty-five years old.

MACHINERY AND TRADE

Conditions in the Cement Block Field.

The development of the concrete block as a building material has been very largely influenced by MUNICIPAL ENGINEERING, which was the first magazine to recognize the full value of the new form of construction and the first to take up a systematic method of spreading information about it. The editorial department was greatly aided by the advertisers of block machines who, beginning with the Palmer machine in January, 1902, have made known the advantages of their various machines. These have also been set forth in this department of the magazine from time to time.

This magazine was the originator also of the National Association of Cement Users which, in the original circulars, was intended to be an organization for cement block makers, and is this year more largely devoted to their interests and those of the machinery and supply men furnishing them with tools and machinery than ever before.

Credit for the work done is assumed by MUNICIPAL ENGINEERING, not with any spirit of self-glorification, but as a basis for the work which it intends to carry forward in the future. From the beginning we have protested against the tendency of block machine makers to exploit the business on the score of cheapness rather than quality, and have frequently accounted for this by the willingness of machine manufacturers to sell machines to any one who would buy, and their constant claim that any one could make a cement block.

The consequence of poor work was predicted and is now experienced, viz.: the cement block is largely relegated to foundation work and the cheapest kind of walls and buildings and is not taking the place at the head of block-form materials for building as it should. Partly on account of the poor quality of blocks turned out, which has been attributed by the ignorant to the machine rather than to the workmanship and material put into the blocks, there has been a flood of patents on machines, and at least four patents each week for the past two years have been granted for cement blocks or bricks, block machines, or walls built of the blocks.

This broadside attack upon the wrong side of the subject has resulted in the entry into the block machine field of many irresponsible persons, irresponsible either because they do not have the necessary capital to develop their inventions, or because they are after the temporary advantage they can get, and as soon as the trade which is easy to reach is supplied are ready to repudiate the obligations they have incurred. Into the latter class sometimes descend those who have a machine for which there is no market, and when their small capital is expended they get out of the field without satisfying their creditors.

MUNICIPAL ENGINEERING has been eliminating such persons and firms from its lists and believes it for the best interests of the trade in general to continue

the campaign against the irresponsible and vicious methods with which the block machine and the block makers' trades have been tainted from the beginning. Only in this way can an upward turn be given to the business as a whole.

With the aid of scientifically constructed building ordinances, if the data for them can be obtained from the official experimenters within a reasonable time, and the example of honest block makers with some architectural and artistic sense, such a campaign as that which this magazine has been carrying on and which it proposes to make even more thorough in the future, may result in visible improvements within a measurable period of time. All the aid of all the enthusiasts in the field is needed all the time to make any large showing of progress.

Largest Producer Gas Power Plant in the World.

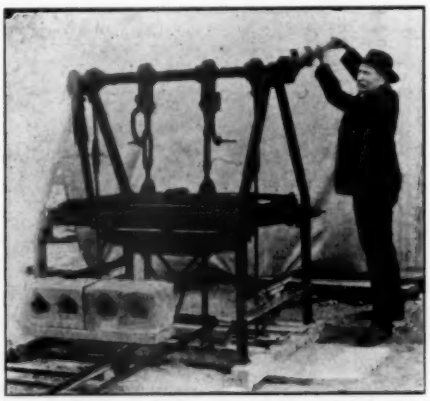
The new plant of the Iola Portland Cement Co., at Dallas, Tex., is notable for the fact that it will have the largest producer gas power installation in the world. At other plants of the Iola company, both gas engines and steam engines have been employed, so that in selecting the type of prime mover for their new plant, their decision was influenced by the saving in fuel consumption by the use of gas.

The Loomis-Pettibone gas generating system will be furnished in three units, having a total capacity of 4500 horsepower. Bituminous coal and Texas lignite will be the fuels used. There will be four single-tandem double-acting gas engines, each with a normal capacity of 1100 brake horsepower, direct connected to alternating current 25-cycle electric generators of 810 kilowatt capacity each, in parallel.

A New Concrete Block Machine.

The Sixbey & Grumme Co., of Portland, Ind., are manufacturing a new combination cement block and brick machine under the patent of Mr. Charles Reed, of Portland, Ind. This machine is different from anything that has yet been placed upon the market. The machine was patented March 6, 1906, but there have been several machines in operation for over a year. The work done by these first machines has demonstrated to the entire satisfaction of their owners and to the manufacturing company, that the machine is speedy in its work, easy of operation, with less manual exertion than any concrete molding machine thus far manufactured. By this machine one concrete block with maximum dimensions of 8x10x32 inches, or two or more smaller blocks totaling 32 inches in length may be made at one time. A number of different style plates are furnished with the machine by which blocks of any ordinary design may be made. The machine also has an interchangeable brick attachment by which ten bricks of uniform dimensions may be made at one operation. The blocks or bricks may be faced on one or two sides. No tamping is required and a pressure of about ten tons may be exerted by the use of the ratchet lever.

The accompanying illustration gives a good idea of the appearance and construction of the machine. It shows two 16-in. blocks lowered and rolled away



REED CONCRETE BLOCK MACHINE.

from the machine just after construction, with the machine filled and pressing another block. An illustration on another page shows 10 bricks lowered to the car ready for removal. The blocks are lowered by a hand lever and there is no danger of any breakage in taking the blocks from the machine. The manufacturers believe that they have the swiftest hand machine for constructing concrete blocks that has yet been constructed and at the same time a machine that is free from liability to breakage. An illustrated catalogue of the machine is now being issued by the Sixbey & Grumme Co., which will be sent postpaid to any one interested.

Bitulithic Pavement is Satisfactory.

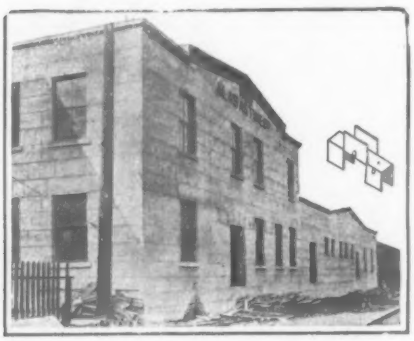
A statement, signed by Bessemer's citizens, was published in the Pueblo, Col., Indicator, recently, indorsing the bitulithic pavement laid on the principal busi-

ness street, two years ago, by the Warren Bros. Company. They stated that, although the paving was completed two years ago, there is not a break, or crack or worn spot in it, but instead, the pavement is more firm and solid now than when it is was put down. They say:

Horsemen like the pavement on account of it being of the non-slippery kind, storekeepers like it because it is of the noiseless kind, and property owners like it because it is of the durable kind.

A Plank Holder for Concrete Wall Forms.

The accompanying cut shows a photograph of a reinforced concrete building, and at the right the plank-holder used in building the forms used in its construction. The holder makes it possible to remove planks as soon as the concrete has set sufficiently, each plank with its holders above the first one being self supported. The inventor claims that not more than one-third as much lumber is required as with ordinary forms and that vertical bracing is not necessary.



SULLIVAN PLANT HOLDER FOR CONCRETE FORMS AND ITS USES.

The holders are of 7-32-in. sheet steel and are made in two sizes, for 7-8 and 1 7-8 in. boards. The latter is the size generally used. The following description of the method of using the plank holders in straight wall work is given by the inventor.

In beginning a wall foundation at or about the basement floor line, first take a two by four, set it on a few dry bricks, level and true to wall line. Do the same on opposite side, making proper allowance for the width of wall you are about to build. Set three plank holders on top edge of a sixteen foot two by four, and temporarily brace the two by four to keep it from bulging. Next place your tie rods through the upper hole in holder, and through the holder on opposite side of wall. Fasten the nut securely on rod, saw off a piece of board the width of your wall, and set same between the planks. This board will be taken out when you put in the concrete and will be used again. Fill in your concrete in the usual manner and properly tamping it down. Continue filling in around the wall on the same level if possible, and when you have filled in to the height of the two by four, and one plank above, you will have to place another plank on top to receive more concrete. When you have this plank placed in position, put in other plank holders on the upper edge of plank, but place the tie rod through the lower hole of each plank holder, and then proceed to fill in with concrete to top of plank, and when same is done tamp in the usual manner. You will now find the lower portion of concrete wall is sufficiently dry to remove the holders, and the two by four you can lay aside for future use. The two by twelve will drop off when the two by fours are removed. You can then place them on top of the remaining plank that you have last filled in with concrete and proceed as before. You will not need more plank, as you can build the wall with this number with perfect safety. You will not need stakes or braces of any kind, from the first temporary stakes up.

Mr. J. H. Sullivan, 2 Norris Block, Grand Rapids, Mich., the inventor of the plank holder, is a contractor and builder of many years' experience and has devised it to help him in his special work of building monolithic walls. He finds it so satisfactory that he has put it on the market. In a booklet he explains fully many methods of using the plank-holder for walls of various cross-sections and plans.

The Art Portland Cement Co.

The Art Portland Cement Co. has completed its plant at Kimmell, Ind., for the manufacture of white cement and the first product of the kilns has proved to be better than the samples made in the laboratory from the same materials. In common with all new plants there are difficulties with motors, shafting and breakages on testing new machines and there has been some consequent delay in delivering cement to the trade, but these difficulties are now nearly all overcome and the product will be on the market to the full capacity of the mill in a short time.

Another Consolidation of Concrete Block Machine Companies.

The announcement is received by telegraph as this number goes to press that the Hoosier Manufacturing Co. and the Concrete Machinery Co., both of Auburn, Ind., have been consolidated with the Cement Machinery Co. of Jackson, Mich., and that the offices and factory of the new organization will be at Jackson.

How to Preserve Macadam Roads.

The worst, and almost the only enemy, of a macadam or hard road is water. The wheels of vehicles grind up the surface of the road, especially when wet. This becomes mud, and in dry weather is dust, and is blown away, leaving the larger stones exposed. In a short time the surface of the road is dissipated, the flesh worn off, and the bones left naked to the elements.

OILED DETROIT BOULEVARD.

Speedway and testing track for automobiles.

We must find something, if possible, to make the surface of this road waterproof, to protect these bones. A great deal has been said and written recently with regard to the use of oil. This was first started for the purpose of laying the dust. It was soon found that a heavy oil with an asphalt base would do more. It would not only eliminate dust, but would form a coating of asphalt on the surface, which would turn the water wherever the road had the proper crown. The only effect of the rain was to wash it clean.

It is reported that the best results in this climate have been secured by the application of what is called "Asphaltoilene," an asphalt oil in which there is from 60 to 65 per cent. of pure liquid asphalt or maltha, with a sufficient amount of petrolene or fluid matter to secure the requisite penetration of the surface of the road. Unless the weather is extremely hot, this should be artificially heated by steam, not by direct heat, as it is practically a liquid asphalt. It should be carefully applied with the proper form of oiler. It will quickly set, and the deposit of pure asphalt on the surface forms an elastic coating, which gradually hardens and forms a completely waterproof surface. It is claimed that a road properly constructed and properly treated will outwear an untreated road three times over and will always be a pleasure to ride or drive over.

The elastic coating seems to form a sort of cushion which prevents the impact of the horses' feet or the pressure of vehicle wheels disturbing or dislocating the particles of crushed stone beneath the surface, and the roadbed continues to be

a substantially solid mass. Therefore the treatment saves 50 to 75 per cent. of the cost of maintenance. The elastic coating takes the wear, eliminates the dust nuisance, and if treated at proper intervals the road or street long remains as originally constructed.

In this age of automobiles, we are face to face with the problem of having our lives made miserable by the dust stirred up, and our roads destroyed by the action of the heavy rubber tires.

If you will select a stretch of perfectly built macadam road, sweep it perfectly clean and free from dust, and observe the action of an automobile tire going swiftly over it, you will probably be able to perceive with the naked eye a small train rising from an inch to an inch and a half above the surface of the road, immediately behind the wheel. This is the binder of the road, being sucked up in fine particles to fall back and to turn into dust and to blow away. If you will examine the track made by this wheel with a glass, you will perceive that these particles have been bodily lifted from the substance of the road to be scattered by the winds. In a short time, this precious binding surface, of vital importance to the road, is gone and the road quickly goes to pieces.

The action of rubber tires on roads treated with "Asphaltoilene" or any very heavy asphalt oil tends rather to smooth them out more effectually, especially when the treatment is comparatively fresh, giving a sort of polished surface, and actually improving the road, and making it more perfectly waterproof. This is owing to the plastic nature of the surface produced by this natural asphalt, which has never been subject to the coking effect of direct heat, as well as its tenacity and adhesiveness to the surface of the road as a binder; and there are no particles picked or sucked up by the automobile tire. The oil used should contain not less than 50 per cent. of pure asphalt or maltha.

All authorities are agreed that dust, blown by the winds, is a most serious vehicle for the spread of infectious diseases. Major Firth, of the English army, has stated that typhoid bacillus may remain alive and fully virulent for twenty-five days in dirt which has been dried and blown about as dust.

It has been said that some years ago, Salt Lake City was afflicted with a very stubborn epidemic of diphtheria. The medical experts were unable to check it until they reached the conclusion that the disease was spread by the dust blown about and from the streets. They immediately proceeded to oil these streets and checked at once the further spread of the disease.

Mr. Madden, a distinguished horse breeder of Fayette county, Kentucky, has has kept careful statistics of the effect of oiled roads upon the horse. The horse is not protected against the effects of inhaling dust as is man, and the tubercular diseases to which horses are subject are doubtless spread by dust. In Fayette county, where almost all the roads, even on the extensive stock farms, are oiled, the horses have become almost entirely free from this class of disease and the hoof diseases have practically disappeared.

The accompanying illustration shows a photograph taken December 13 of a Detroit boulevard which has been used for over five months by not less than 500 automobiles a day, as it serves for a testing road for some ten automobile manufacturers, as well as for a speedway for private owners. It has been treated with heavy asphalt oil, "Asphaltoilene."

The Largest Concrete Wall Yet Built.

A concrete wall just completed at Duquesne, Pa., is said to be the largest ever constructed of that material. It is 1,800 feet long, and starting at a height of seven feet, it attains a height of 47 feet. Over 200 men were employed six months in building the wall. Its cost is estimated at $25,000. The wall will be used by the United States Steel Corporation as a route for hot metal and cinders.

Michigan Paving Brick.

The Michigan Paving Brick Co. have just closed their plant for the year, after having had a very successful season. Their plant and shale pit are located near Omer, Arenac Co., Michigan, with main office in Saginaw. The company make good quality paving brick and fine face brick for building purposes. The company reports that the brick have been tested as to quality a number of times and proven equal to the best in the country. The plant has a capacity of 50,000 brick per day.

The shale pit, which is located on the bank of the river, opposite the factory, is 40 feet deep and covered with 3 feet of black soil. There are three kinds of shale —first, the dark; second, the white, which makes a beautiful buff brick, and third, one which is a fine dark red colored brick. These two latter kinds are in great de-

mand by architects and builders for building purposes.

The shale is taken across the river in dump cars and dumped into the pan house, where it is ground and sent up by a cup elevator to the pug mill. Here it is pugged and goes through the brick machine and represser, and there the bricks land on cars, which are shoved into the dryer and dried with waste heat from the kilns.

The company has operated the plant for three years and have it in fine running order and expect to do big business next season.

An Adjustable Cement Walk Trowel.

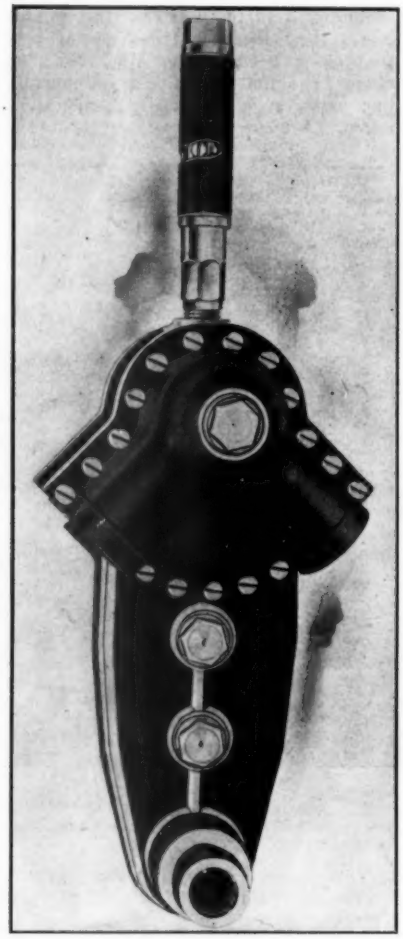
Mr. P. F. Connelly, a successful contractor of Sioux Falls, S. D., has developed for his own use an adjustable trowel for finishing cement walks which has been so satisfactory that he is getting it in shape to put on the market after some months of experimentation. The tool is composed of a trowel, edger, jointer, pointing trowel, and roller, all in one tool. The handle is long so that the operator stands on his feet and is no longer obliged to work on his hands and knees, stretched over the work he is doing. The various parts of the tool are readily substituted on the handle and are adjustable in angle and position so as to reach all parts of the surface in the proper way. The inventor claims that a man can do better work at much faster rate than with the ordinary tools. Mr. Connelly's last patent is dated Dec. 17, 1906, and he will doubtless send full description of the tool to inquirers, although his arrangements for manufacture of tool and printing of circulars are not yet completed.

Exhibit of Hercules Cement Block Machines.

The Century Cement Machine Co., of Rochester, N. Y., makers of the Hercules concrete stone machine, have arranged for a magnificent exhibition and a complete demonstration of their products at the convention of the National Association of Cement Users, to be held in Chicago, January 7 to 12. They say it will be a show worth seeing, and that our readers should not miss it.

Drills for Special Purposes.

The accompanying photograph shows a view of the new "Little Giant" drill of the Chicago Pneumatic Tool Co., designed for corner work. From past experience in air tool practice, the company feel justified in the statement that this new drill surpasses any other drill yet devised for drilling in close quarters and in corners particularly; the machine having been designed especially for work in the latter class. Parts for their No. 4 Little Giant



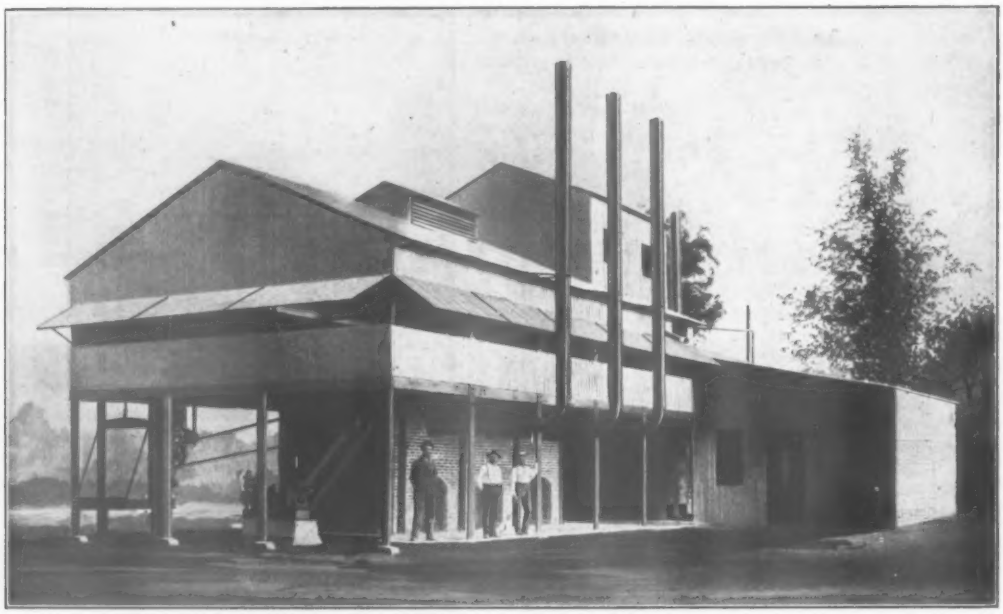
LITTLE GIANT DRILL.

drill interchange with the new drill mentioned, thus insuring quick repairs.

This new tool weighs but 35 lbs.; capacity 1½ in. (but in emergency cases will drive 2 in. twist drills with very satisfactory results); spindle speed, when running light, 150 r. p. m.; under load with 80 lbs. air pressure, 100 r. p. m.; distance from end of socket to end of feed screw when run down, 5 7-8 in.; length of feed, 2 in.; distance from center of spindle to outside of housing, 1 5-16 in.

In addition to the fact that it is the most powerful drill ever devised, weight considered, it possesses advantages over other designs of corner drills, owing to the spindle being driven by gears instead of ratchet principle, which insures steady and constant spindle movement.

They also make the "Midget" drill, with a capacity for drilling up to and including 3-16 in. in steel. Its weight is 2 1-2 lbs.; distance from top of breast plate to end of spindle, 7.5-12 in.; from center of spindle to outside of housing, 1 in.; motor speed, 22,000 r. p. m.; spindle speed, 2,000 r. p. m.



HETHERINGTON ASPHALT PAVING PLANT.
Memphis Asphalt and Paving Co., Memphis, Tenn.

This machine is of the rotary type. It therefore operates at full speed without vibration and is particularly adapted to drilling tell-tale holes in stay-bolts or light work where accuracy is required. These machines are produced and marketed by the Chicago Pneumatic Tool Co., Fisher Bldg., Chicago.

The New Asphalt Plant of the Memphis Asphalt and Paving Co.

The illustration which accompanies this article represents the new asphalt paving plant installed during the past season, in the city of Memphis, Tenn., by the Memphis Asphalt and Paving Co., of that city. The plant was manufactured by Hetherington & Berner, of Indianapolis, Ind., and is said by that company to be the most complete outfit of the kind that they have yet designed. It is of absolutely fireproof construction; the framing of the building being made of structural steel and the floors of concrete. In this plant the system of overhead storage for material leaving the heaters is carried out as far as possible. Not only is there a steel plate bin for the product of the sand dryer, but also for the storage of binder material and limestone dust. By reason of these appliances the minimum amount of hand labor is required in the operation of the plant.

One of the original features of this plant is the peculiar arrangement of the elevators which feed the dryer, it being so designed and constructed that one side may be used for feeding binding material and the other for sand. The installation of melting kettles for this plant consists of three mechanical agitators of 350 cubic feet capacity each, which equals about 95,000 pounds of asphaltic cement in all. The Hetherington pneumatic mixer service is used to supply the mixer with material from these agitators, doing away with all hand labor in this respect. The plant has provision

for two mixing machines, one for mixing binder and one for mixing topping. Hitherto this company has been conducting extensive paving operations in Memphis and elsewhere, using for that purpose a two-car Hetherington railway plant. Their business has increased to such extent that the installation of this new plant became a necessity. They are now engaged in laying 50,000 yards of sheet asphalt in Memphis. They have just completed 11,000 yards in Montgomery and were recently awarded two streets aggregating 8,000 yards more. With their new plant they expect to turn out paving material more cheaply than any other paving plant in the country.

Trade Publications.

The December circular of the Universal Portland Cement Co. shows the main dam of the Great Northern Power Company near Duluth, Minn., in which over 60,000 barrels of Universal Portland cement was used.

Samuel H. French & Co., York Ave., Fourth and Callowhill streets, Philadelphia, Pa., have issued an illustrated booklet descriptive of a hanging concrete stairway reinforced with expanded metal, in which Dexter Portland cement was used.

Milliken Bros., 11 Broadway, New York City, have issued a pocket book showing the forms and properties of the structural steel sections manufactured by them in their new mill at Milliken, Staten Island.

Trade Notes.

ASPHALT.

Toronto, Ont.—Tenders are asked until Jan. 8 for supplying and erecting a municipal asphalt paving plant and equipment. E. Coatsworth, Mayor.

New York City.—The contract for furnishing, delivering and erecting a municipal asphalt plant for Brooklyn was awarded to Hetherington & Berner, of Indianapolis, Ind., for $16,500.

Ottawa, Ont.—This city will purchase an asphalt plant at a cost of about $10,000. E. R. Beckwith, City Engineer.

Washington, D. C.—The District Commissioners have asked for authority to purchase a municipal asphalt plant.

Philadelphia, Pa.—The factory of the Filbert Paving and Construction Co., 30th and Locust sts., was destroyed by fire Dec. 16.

BRICK.

Dillsburg, Pa.—The Dillsburg Vitrified Brick Co. contemplates the construction of a plant with a daily capacity of 30,000 brick and the most up to date equipment.

Cape Charles, Va.—The Old Dominion Granite Brick Co. has been organized and will erect a brick manufacturing plant. The officers of the company are: President, H. A. Knapp; treasurer, V. L. Peterson, of Scranton, Pa.; vice-president, L. M. Sturgis, of Cape Charles.

El Paso, Tex.—A company has been organized for the purpose of erecting a plant for the manufacture of sand-lime brick. The officers of the new company are: President, J. L. Stuart; vice-president, A. Courchesne; secretary and treasurer, S. H. Sutherland. The promoters expect to have the plant in operation by January 1.

Malad, Idaho.—The Malad Block, Brick & Cement Co. has been organized.

Hempstead, L. I.—The Long Beach Sand Brick Co. has been organized to manufacture brick, utilizing the beach sand from Jones and other inlets.

Crookston, Minn.—O. K. Berget has been made manager of the Crookston Brick & Tile Co.

Omaha, Nebr.—The Omaha Brick, Tile & Paint Co. has been incorporated by Peter Iler, J. M. Daugherty and William D. McHugh.

Loveland, Colo.—The Loveland Paving & Pressed Brick Co. has been incorporated by Fred N. Briggs, James C. Johnson and Rufus R. Fountain.

CEMENT.

Coffeyville, Kans.—Special.—The Dewey Portland Cement Company was incorporated recently under the laws of West Virginia and has already commenced the erection of a 2,500 barrel plant at Dewey, Oklahoma. The site at Dewey was selected, as at that point is found an abundance of gas, fine quarries of rock and shale, combined with exceptional shipping facilities. Electric power will be used throughout the plant and will be furnished from three-phase electric generators direct connected to four 600 horse-power engines. About fifty motors, aggregating 2,500 h. p. will be used, it being the purpose of the company to drive each and every important machine or apparatus by an individual motor. Thus in case of breakdown only one machine is out of commission and the production of the plant is held at the maximum. The main buildings will be steel and concrete, and will house a plant equipped with the latest and best equipment. Every detail, mechanical and electrical, will be the result of the most skillful design and engineering skill. The plant will be compact and strong throughout, reliable and as nearly indestructible as possible. Contracts are now being let for the cement machinery, the buildings, power equipment and crushing plant having already been purchased. Work is being pushed on the plant and it is expected that it will be in operation by the early summer. The officers of the company are: F. E. Tyler, president and general manager; F. L. Williamson, vice-president; J. H. Keith, secretary; J. R. Mulvane, treasurer; C. M. Ball, assistant treasurer. The main office of the company is at Coffeyville, Kansas, I. O. O. F. Building.

Spokane, Wash.—J. H. Spear, mgr. of the Washington Brick, Lime & Mfg. Co., and associates, contemplate the organization of a company and the erection of the largest and most modern cement plant in the Northwest. The plant will be located either at Colville, Wash., or on Pend d'Oreille lake, Idaho. Extensive cement beds have been secured at both locations. Associated with Mr. Spear are Aman Moore, a cement engineer, and C. T. W. Hollister, formerly with the Portland Cement Co. of Colorado, with head-

quarters in Denver. The company will be called the Inland Portland Cement Co.

Portsmouth, O.—The York Portland Cement Co. has been incorporated by Levi D. York, Dudley B. Hutchins, Wells A. Hutchines, Raymond D. York and Edward D. Stevens.

Detroit, Mich.—Federal Judge Swan recently appointed the Michigan Trust Co., of Grand Rapids, receiver for the Great Northern Portland Cement Co. which has a plant at Marlborough, Lake county, Mich. The company is capitalized at $4,000,000 and its plant cost $1,000,000. The company established the town of Marlborough. The receivership was brought about by the Union Trust Co., of Detroit, which sued for the franchise of a mortgage it held as trustee. The company defaulted in the installment of interest due on a mortgage on the plant of $600,000, due Nov. 1, and the receivership is said to be for the purpose of conserving all the interests involved with a view to keeping the plant intact and operating it during 1907.

Reading, Pa.—John M. Frame, trustee in the bankruptcy proceedings of the Reading Cement Co., filed his account recently relating to the real estate with Referee in Bankruptcy S. E. Bertolet, who fixed Dec. 3 as the date for the hearing. The account shows that the machinery of the plant and the buildings and site were sold at public sale for $15,000 and other tracts brought $450, $1,925 and $60, respectively, making a total of $17,435. After deducting all expenses there remained $14,800.75 due the estate.

Cody, Wis.—Within three miles of this town seemingly inexhaustible deposits of materials for manufacturing Portland cement have been located. The deposits are on the land of George Nash.

Colorado Springs, Colo.—The Interstate Cement Co. has been incorporated by R. P. Davie, S. D. Bartlett, E. B. Skinner, J. R. McKinnie and C. Reyer.

Fort Scott, Kans.—C. F. Martin is promoting a large cement plant to be locata few miles east of here at a point known as "Diamond pasture."

York, Pa.—A large tract of land has been purchased here by the Sandusky Portland Cement Co., of Sandusky, O., and a Portland cement manufacturing plant will be established.

Pine Bluff, Ark.—Milwaukee capitalists contemplate establishing a cement plant here.

Ogden, Utah.—A company will be organized by H. C. Baker and a plant for the manufacture of Portland cement will be erected next spring at Box Elder, near Brigham City.

Montreal, Que.—The Newgan Cement Works, located on the outskirts of this city, have been purchased by a syndicate of New York and Montreal capitalists, who are forming a strong combine for the manufacture of cement, both in the United States and Canada. Ground will be broken at once for a plant in Montreal with a yearly capacity of 600,000 barrels. The plans call, however, for a plant which will eventually have a capacity of 1,200,000 barrels, and which will be completed next spring. Among the prominent capitalists included in both countries in the syndicate is W. R. Warren, of the Warren-Burnham Co., of New York.

Rockland, Me.—The Dirigo Portland Cement Co. has been incorporated with officers as follows: President, Reuben Leland; treasurer, F. E. Holman; clerk, E. B. McAllister.

Seattle, Wash.—The Pyramid Portland Cement Co. has been organized by Jas. T. Lawler, John F. Stehle and D. Carmody.

Salt Lake City, Utah.—The Utah Plaster Co. has been incorporated to mine and mill gypsum and manufacture plaster. The officers are: President, W. J. Robinson; vice-president, W. H. McIntyre; secretary, J. W. West; assistant secretary, W. Bert Robinson; treasurer, Edward L. Burton.

Oakland, Cal.—The Sonora Concrete Cement & Lime Co. has been incorporated. The principal place of business will be in this city.

Winnipeg, Man.—The Manitoba Gypsum Co., Ltd., whose mill was destroyed by fire last July, is considering the question of rebuilding, the plant to be located in this city.

San Francisco, Cal.—The Northwestern Portland Cement Co. has been incorporated.

Elizabeth, Pa.—The plant of the International Portland Cement Co., near here, was damaged by fire Dec. 7, to the extent of $200,000.

Alpena, Mich.—The Huron Cement Co., a new cement manufacturing concern, will erect a large plant here. The company will have temporary offices in the Comstock block.

Maryville, Kans.—The American Cement Plaster Co., with headquarters at Leavenworth, has purchased the new plaster mill of the Blue Rapids Gypsum Co., at Blue Rapids, Kans.

Egypt, Mich.—The Egypt Cement Plant has been temporarily closed down.

Laramie, Wyo.—The Overland Plaster & Cement Co. has been incorporated and will build a plant near here for the manufacture of plaster and cement from gypsum.

Bellingham, Wash.—The Chuckanut Portland Cement Co. has been incorporated by H. Edwin Moore, of Los Angeles; Clancey M. Lewis and Theodore Maynard, of this city.

Rondout, N. Y.—The plant of the New York Cement Co. was destroyed by fire Dec. 13, entailing a loss of $250,000.

Salt Lake City, Utah.—The Perkins Portland Cement Co. has been incorporated with officers as follows: President, Walter K. Perkins; vice-president, E. D. Hashimoto; treasurer, Heber M. Wells; secretary, J. M. Bowman.

Denver, Colo.—H. O. Bush, traffic manager of the Colorado Midland, announces the discovery of a mountain of cement plaster rock on the western slope near Ruedi. A company, to be known as the Roaring Fork Plaster Co., has been organized and the plant will be in operation by next May or June. E. J. Bess, of Florence, and Dr. D. G. Cummings are interested.

Crivitv, Wis.—A large deposit of marl near this city is to be developed and a cement plant erected.

Seattle, Wash.—The West Coast Portland Cement Co. has been incorporated by J. M. Edwards, T. B. Agnew, Rollo T. Smith and C. W. Chamberlain.

Reading, Pa.—The Vindex Cement Co. has been incorporated to take over the property of the Reading Cement Co., at Molltown, which was purchased by a committee of the bondholders in the bankruptcy proceedings. The new company expects to put the plant in operation in a short time.

Evanston, Wyo.—The proposed plaster mill at Portland is being established, and

it is claimed that it will soon rank among the leading cement mills in the country.

Trenton, N. J.—The North American Portland Cement Co. has been incorporated to deal in Portland cement, and also to acquire stock of other companies. The incorporators include H. E. Trexler and E. M. Young, of Allentown, Pa., and A. F. Gerstell, of Easton, Pa. The incorporation is in behalf of six existing Portland cement concerns—the Atlas, Alpha, American, Vulcanite, Lawrence, and Lehigh companies. No merger is contemplated, but the seven companies will be closely affiliated through the board of directors of the North American, which will give them the opportunity to watch prices closely.

CONCRETE BLOCKS.

Philadelphia, Pa.—The Unit Concrete Steel Frame Co. announces changes in the organization of the company.

Warren Webster & Company, of Camden, N. J., having bought the whole of the Unit stock, together with all patents granted and pending, and the entire interests in the said Unit Company, of the following gentlemen, who have resigned their several respective offices in the company as formerly organized, namely: A. C. Middleton, president and director; E. G. Perrot, vice-president and director; W. F. Ballinger, treasurer and director. The business of the company will hereafter be entirely in the hands of Warren Webster Co., with the following officers: Warren Webster, president; Theodore L. Webster, vice-president; S. R. Horn, secretary and treasurer. The company is pleased to place at the disposal of architects, engineers and reinforced concrete contractors, the services of their staff of experts in laying out new work and securing contracts based on the best modern practice.

Kenyon, Minn.—W. C. Luebke contemplates enlarging his facilities for the manufacture of cement brick next season.

Sioux Falls, S. D.—W. L. Dow has invented a power concrete block machine.

Wynne, Ark.—A concrete block plant will be established here by H. H. Stafford and J. B. Hamilton.

East Liverpool, O.—The Norfolk Concrete Building Block & Construction Co. has been incorporated by Wm. Polk, Louis E. Polk, Fred Polk, R. L. McKenty and O. A. Robertson.

Bay Minette, Ala.—Nelson Shoplinton and others contemplate erecting a plant for the manufacture of cement blocks.

Racine, Wis.—The cement block plant of E. C. R. Skow was damaged by fire Dec. 5.

Houston, Tex.—The Texas Concrete Construction Co. has been incorporated by B. B. Jones, of Houston Heights; S. S. Ashe and F. J. Sargent, of Houston.

Milwaukee, Wis.—The Badger Cement Products Co. will erect a one-story factory building at Humboldt avenue and Chambers street. The building is to be used for the manufacture of cement blocks and will be constructed of cement blocks made by the company.

Columbus, O.—The Simpson Cement Mold Co. has been incorporated by Joseph, H. G., B. L., and Matilda Simpson, and Victoria S. Bending.

St. James, Minn.—A. W. and Henry Schweppe and Josiah Schmidt have formed a partnership to be known as Schweppe Bros. & Schmidt, and will engage in the manufacture of cement drain tile.

Pittsburg, Pa.—The Pittsburg Cement Corporation has been incorporated to manufacture all kinds of products of Portland cement, by Alexander W. Gilmore, John B. Johnston and Albert L. Klauser.

Milwaukee, Wis.—The Berthelet Concrete Stone Co. has been incorporated by J. H., W. T. and V. E. Berthelet.

PURCHASE OF MACHINERY.

Passaic, N. J.—Special.—Swenson Bros. Building Co., 237 Main ave., are in the market for a concrete mixer.

Grand Island, N. Y.—Special.—Fremont Simonds is in the market for mixing machines, excavators and concrete tile machines.

Arlington, Ind.—Special.—Davis Ewing desires to purchase concrete mixers and sidewalk tools. Mr. Ewing expects, after January 1, 1907, to handle cement and stone at Bloomington, Ill.

Sidney, Ia.—Special.—E. A. Abshire is in the market for sidewalk and block machinery and tools.

Mitchell, Neb.—Bids are asked until Jan. 24, for supplying 125,000 lbs. of steel bars for reinforcement of concrete. U. S. Reclamation Service.

PURCHASE OF MATERIALS.

Providence, R. I.—Special.—Chas. A. Borgstrom, 27 Reynolds ave., is in the market for cement.

Sidney, Ia.—Special.—E. A. Abshire is in the market for sand and cement.

Grand Island, N. Y.—Special.—Fremont Simonds is in the market for cement, sand and stone.

MISCELLANEOUS.

The Universal Destructor Co., 17 State St., New York City, of which Col. Wm. F. Morse is engineer in chief, is the agent in this country for the Morse and Meldrum systems of garbage and refuse destruction.

Memphis, Tenn.—Sealed bids are asked until Jan. 16 for furnishing metal street signs. James H. Malone, mayor.

Milwaukee, Wis.—The Ball warning device for bridges, invented by Walter J. Murray, supt. of bridges, has been successfully tried and the installation of similar mechanism on every bascule bridge crossing the three rivers of this city has been authorized by Com. of Pub. Wks. Sherer.

Springfield, Ill.—The Springfield Garbage Co. has been incorporated by A. H. Valno, J. N. Dixon and A. M. Fitzgerald.

Chicago, Ill.—The playground association of Chicago, civic incorporators, has been incorporated by Frederick Greely, Graham R. Taylor and Clarence Buckingham.

Guthrie, Okla.—The Continental Engineering Constr. Co., of Guthrie and New York, has been incorporated by G. V. Pattison, H. W. and L. E. Penticost, of Guthrie.

Oklahoma City, Okla.—V. R. Gott has established a shop in this city to build dump wagons, patents on which he secured recently.

Patents Concerning Cement and Its Uses.

821,569. Armored Cement. Pierre Zucco, Baltimore, Md.

821,642. May 29, 1906. Concrete

Block Machine. Thos. C. Holt, Minneapolis, Minn.

821,675. Sewer Appurtenance (Manhole, Etc.). Frederick E. Shaw, Providence, R. I.

821,738. Mold for Concrete Posts. Leverett A. Pratt, Bay City, Mich.

821,790. Concrete Mixer. Joseph Dorweiler, West Bend, Iowa.

821,824. Form for Concrete Sewer Construction. Robert J. Paul and Wm. C. Kershner, Dayton, O.

821,869. Form for Concrete Construction. Harold W. Hathaway, Dayton, O.

822,013. Apparatus for Forming Artificial Stone Building Blocks from Concrete. Albert A. Pauly, Youngstown, O.

822,038. Tile Molding Device. Herman Besser, Alpena, Mich.

822,039. Molding Device. Herman Besser, Alpena, Mich.

822,040. Mold for Hollow Articles. Herman Besser, Alpena, Mich.

822,047. Tubular Concrete Metal Construction. Walter C. Hooper and Pierre Zucco, Baltimore, Md.

822,078. Cement Building Block. Geo. W. Roberts, Ravenna, Neb.

822,140. Well Pit Mold Frame. Wm. H. Lucas, Newark, O.

822,284. June 5, 1906. Concrete Mold. Israel L. Landis, Chicago, Ill.

822,320. Building Block and Walk Constructed Therefrom. Augustus O. Thomas, Kearney, Neb.

822,333. Concrete Building Block Machine. Ithamer E. Yarnell, Toledo, O.

822,499. Concrete Structure. John F. Ancona, Proctor, Vt.

822,510. Wall Construction. John C. Davidson, Columbus, O.

822,524. Means for Making Artificial Building Stone. Oliver B. Kaiser, Norwood, O.

822,587. Metal Reinforced Concrete Column. Robert A. Cummings, Beaver, Pa.

822,588. Method of Sinking and Building Concrete Piles. Robert A. Cummings, Beaver, Pa.

822,589. Method of Sinking Concrete Piles. Robert A. Cummings, Beaver, Pa.

822,594. Wall. John A. Ferguson, Denver, Colo.

822,705. Pipe or Conduit. Chas. H. Wilson, Red Oak, Iowa.

822,838. Culvert Machine. Jas. M. Fluke, Nankin, O.

823,139. Fence Post Mold. Peter L. Schaaf, Botkins, O.

823,141. Sewer Pipe. Frederick E. Shaw, Providence, R. I.

823,208. Railway Tie. Robert C. Doerr, Chicago, Ill.

823,246. Waterproofing Composition. Julius Wessel, New York, N. Y.

823,457. Mold for Cement Posts. John T. Wilson, Des Moines, Iowa.

823,655. Fence Post. Joseph W. Westlake, Marysville, O.

823,893. Portable Burial Vault. Wm. Parry, Crown Point, Ind.

823,950. Floor of Artificial Stone. Paul Langguth, Charlottenburg, Germany.

823,963. Cement Mold. Willard F. McNamire, Mendon, O.

824,117. Fence Post. Robert S. Hiltner, Lincoln, Neb.

824,192. Mold for Concrete Wall Construction. Bernhard A. Mueller, E. St. Louis, Ill.

824,193. Core for Concrete Wall Construction. Bernhard A. Mueller, E. St. Louis, Ill.

824,204. Concrete Mixing Machine. Wm. H. Phillips, Columbus, O.

824,235. Mold for Making Artificial Stone. Nelson L. Damon, Carthage, Mo.

824,470. Building Construction. Geo. H. Dyer, San Francisco, Cal.

824,548. Extensible Dome Form for Cement Cisterns. Francis R. Keiser, Indianapolis, Ind.

824,557. Mold (Cistern, Etc.). Wm. H. Lucas, Newark, O.

824,562. Fence Post. Isaac N. Miller, Somerset, Ind.

824,563. Wall Structure. Liberty Millet. Hagerman, Idaho.

824,594. Concrete-Steel Construction. Edson M. Scofield, Philadelphia, Pa.

824,595. Supporting Device for Reinforcing Bars of Concrete Steel Construction. Edson M. Scofield, Philadelphia, Pa.

824,823. Concrete Wall House Construction. Edward E. Schackner, Denver, Colo.

824,855. Block Mold. John R. Foster, and Fred P. Lang, Indianapolis, Ind.

824,924. Concrete Block Making Machine. Wm. H. Fulcher, Oakland, Cal.

825,052. Concrete Construction. Francis M. Henry and John G. Madden, Minneapolis, Minn.

825,088. Manufacture of Artificial Marble and Stone. Thos. M. Thorn, Cheshurst, Eng.

825,107. Machine for Making Concrete Blocks. Chas. O. Brandell, Chicago, Ill.

825,166. Machine for Making Brick and Artificial Stone. Geo. Wettlaufer. Stratford, Can.

825,183. Apparatus for the Construction of Plastic Walls. David W. Bover, Waterloo, Iowa.

825,243. Manufacture of Artificial Stone Pipes, Tile, Etc., and Apparatus Therefor. Emil H. Rieter-Dodner, Kyburg, Switzerland.

825,284. Beam Clamp and Support for Reinforced Concrete Forms. Wm. H. Dillon, Detroit, Mich.

825,305. Apparatus for Manufacturing Cement. Carleton Ellis, New York City.

825,392. Reinforced Concrete Sectional Conduit. Hugh J. Keenan and Edmund J. Tobin, Jackson, Mich.

825,489. Block Machine. Charles L. Scott, Riceville, Iowa.

825,599. Reinforced Concrete Pile. Wm. H. Healy, San Francisco, Cal.

825,604. Fittings for Concrete Casings. Frederick A. Koetitz, San Francisco, Cal.

825,627. Reinforced Concrete Construction. Charles P. Weeks, San Francisco, Cal.

825,703. Fence and Other Post. Earl M. Bunce, Fenton, Mich.

825,846. Making Cement Structures Waterproof. Gustav H. Liebau, Metuchen, N. J.

825,884. Reinforcing Truss for Concrete. Edgar B. Jarvis, Toronto, Can.

825,918. Sidewalk Block Molding Machine. Arthur P. Melton, Minneapolis, Minn.

825,919. Brick Molding Machine. Arthur P. Melton, Minneapolis, Minn.

826,181. Mold for Making Bell-Mouthed Concrete Pipe. Arthur P. Melton, Minneapolis, Minn.

826,289. Plastic Block Molding Machine. Theodore F. Timby, Alma, Mich.

826,290. Mechanical Movement. Theodore F. Timby, Alma, Mich.

826,375. Metal Reinforcement for Concrete Beams or Other Concrete Structures. Joseph Snowball, Pittsburg, Pa.

826,381. Method of Making Concrete Slabs or Blocks and Apparatus Therefor. Wm. R. Stanton, Jas. W. Knights and Wm. Drake, Cambridge, England.

826,387. Mold. Augustus O. Thomas, Kearney, Neb.

826,388. Building Block and Wall Constructed Thereof. Augustus O. Thomas, Kearney, Neb.

826,467. Mold for Building Blocks. Jas. M. Bolton, Washington, D. C.

826,576. Machine for Molding and Pressing Building Blocks. Julius Jaeger, Rutherford, N. J.

826,597. Construction of Foundation Walls. Clark A. Newman, Atlantic City, N. J.

826,599. Machine for Molding Building Blocks. Levi P. Normandin, Jackson, Mich.

826,777. Building Block and Wall. John A. Ferguson, Denver, Colo.

826,878. Form for the Construction of Plaster and Concrete Structures. Geo. H. Pegram, New York City.

826,970. Method of Molding. Maurice T. Stevens, Harvey, Ill.

826,973. Fence Post. Joseph A. Tremblay, Tilbury, Can.

826,989. Fabric for Cement Plastering and Concrete. Busso von Busse, Marienwerder, Germany.

827,013. Double Interlocking Concrete Slab Crib. Michael J. Haney, Toronto, Can.

827,158. Composition of Matter to be Used in Making Waterproof and Polishable Cements. Paul O. Krottnauer, Chicago, Ill.

827,224. Cement Post for Wire Fences. Orin Fleming, New Sharon, Iowa.

827,436. Cement Railroad Tie and Rail Fastener. Robert Fullerton, Des Moines, Iowa.

827,517. Process of Burning Cement Clinker by Flame Impingement and Apparatus Therefor. Carleton Ellis, White Plains, N. Y.

827,535. Concrete Pile. Julius Kahn, Detroit, Mich.

827,613. Anchorage for Concrete Structures. James A. Brown, Philadelphia, Pa.

827,712. Mold for Concrete Walls. John J. Daniel, Cambria, Wis.

827,892. Reinforced Concrete. Avila Thomas, Detroit, Mich.

828,031. Art of Making Imitation Stone Fronts. Ernest G. Kemper, St. Louis, Mo.

828,041. Building Material. Mark W. Mariden, Philadelphia, Pa.

828,056. Molding Machine. Harry J. Schade, Los Angeles, Cal.

828,076. Method of Holding and Raising Forms for Building Concrete Tanks and Buildings. Francis E. Vansant, Topeka, Kan.

828,140. Mold. Issachar Robbins, Wilkes-Barre, Pa.

828,418. Mold for Cement Cisterns. Grant G. Myers, Sterling, Ill.

828,429. Cement Fence Post. Flavius W. and Elmer G. Shellabarger, Dayton, Ohio.

828,469. Bridge Pier. Chas. E. Fowler, Seattle, Wash.

828,550. Cement and Concrete Binder. Chas. T. Inman and Henry A. Robinson, Akron, O.

828,555. Rotary Kiln. Paul O. Krottnauer, Chicago, Ill.

828,718. Track Construction for Street and Other Railways. Reuben D. Culver, Veedersburg, Ind.

828,719. Mold for Concrete Roof Structures. John J. Daniel, Cambria, Wis.

828,727. Brick Molding Machine. Edward A. Enos, East Connersville, Ind.

828,761. Caisson. Daniel E. Moran, Mendham, N. J., and John W. Doty, New York City.

828,766. Collapsible Mold. Charley W. Overturf, Dumont, Ia.

828,767. Machine for Making Concrete Blocks. Harmon S. Palmer, Washington, D. C.

828,818. Building Wall and Block for same. Edwin A. Hood and Frank L. Fuller, Pierre, S. D.

828,837. Reinforced Concrete Cross-Tie. Wm. A. Bryant, Wetumpka, Ala.

828,931. Concrete Column and the Like. Robert A. Cummings, Beaver, Pa.

828,976. Process for Rapid Hardening of Cement. Herman Schneider, Cincinnati, O.

828,991. Composite Railway Cross-Tie. Julius H. G. Wolf, San Francisco, Cal.

828,993. Concrete Building Block. David J. Ames, Minneapolis, Minn.

829,012, 829,013. Art of Making Cementitious Products or Artificial Stone. Wm. E. Jaques, Grand Rapids, Mich.

829,014. Apparatus for Making Cementitious Products or Artificial Stone. Wm. E. Jaques, Grand Rapids, Mich.

829,150. Fence Post. James F. Haffey, Tiffin, O.

829,203. Railway Tie. Wm. W. Green, Niles, Mich.

829,227. Concrete Constructing Machine. Albert A. Pauly, Youngstown, O.

829,228. Concrete Construction. Albert A. Pauly, Youngstown, O.

829,249. Method of Making Ornamental Molded Concrete Articles. Geo. H. Bartlett, Boston, Mass.

829,329. Construction of Concrete Walls. David Ewart, Ottawa, Can.

829,372. Fence Post. Gustave Eichhorn, West Point, Ia.

829,377. Mold. Geo. H. Bartlett, Boston, Mass.

829,380. Concrete Block Molding Mechanism. Samuel R. Ball, Oil City, Pa.

829,397. Fence of Concrete or the Like. Carl L. F. Gerber, Roebel, Germany.

829,431. Valve Bag. John Rogers, Cleveland, O.

829,561. Concrete Mixer. Cyrus S. Wert, Kendallville, Ind.

829,711. Concrete Building Block. Percy W. Gaylor, Rye, and William Dubee, Brooklyn, N. Y.

829,712. Plastic Molding Machine. Wm. S. Goodwin, New York, and Chas. I. Williamss, Utica, N. Y.

829,940. Composition Post or Analogous Structure. Russell B. Bennett, Westerville, O.

829,956. Process of Burning Cement. Byron E. Eldred, New York, N. Y.

829,957. Apparatus for Making Cement Clinker. Byron E. Eldred, Bronxville, N. Y.

830,003. Process of Rendering Cement Blocks Waterproof. John M. Ranhoff, Tinley Park, Ill.

830,094. Wall Construction and Concrete Block for the Same. Melville C. Momsen, Armour, S. D.

830,108. Fence Post. Martin A. Smith, Buckland, O.

830,132. Concrete Block Machine. Chas. Clayton, Dayton, O.

830,150. Centering Construction. L. L. A. Himmelwright, New York, N. Y.

830,157. Cement Block Machine. Luke T. Lowe, Bristol, Tenn.

830,204. Method of Making Hollow Objects, Conduits, etc. Jas. W. Boyle, New York, N. Y.

830,345. Tunnel Lining of Reinforced Concrete Blocks. Albin F. Mattson, Philadelphia, Pa.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Detroit, Mich.—Park com'r Breitmeyer has canceled the contract with Lennane Bros. for the construction of a speedway on the Western boulevard.

Atlanta, Ga.—Henry L. Collier, com'r of pub. wks., has proposed that the old asphalt from Peachtree st. be submitted to chemical treatment and then used to pave other streets and the street committee has authorized him to make the experiment.

Indianapolis, Ind.—A temporary restraining order against this city and the board of public works was granted Dec. 17 by Judge Carter of the Superior court, ordering the board to not let a contract for the proposed paving of 14th st. from College to Cornell ave. with bitu-mineral. The basis of the suit, which is brought by the Physio-Medical College of Indiana, a property owner in the street, is that bitu-mineral is not an improved and accepted kind of city pavement.

CONTEMPLATED WORK.

Lincoln, Ill.—Paving is contemplated for 5th st.

Oshkosh, Wis.—Paving is contemplated for Church st.

Pascagoula, Miss.—About $35,000 will be expended on paving.

Little Rock, Ark.—Plans are formulated for paving W. 9th st.

Fond du Lac, Wis.—Paving is contemplated for a number of streets.

Marinette, Wis.—Plans are being prepared for paving several streets.

Hattiesburg, Miss.—Bonds will be issued for additional street paving.

Austin, Minn.—Council will investigate tar macadam for paving purposes.

Roswell, N. Mex.—The question of paving the principal streets is being urged.

Bucyrus, O.—A petition is being circulated asking that E. Mansfield st. be paved.

Cleveland, O.—An ordinance has been passed for paving Juniata ave. with brick.

Tacoma, Wash.—The construction of a macadamized road is urged to Point Defiance Pass.

Champaign, Ill.—Estimates are being prepared for paving at a probable cost of $200,000.

Lorain, O.—The property owners on Franklin st. will revive the question of paving that street.

Alton, Ill.—Paving is contemplated for a large number of streets during 1907. Mayor Beall.

New Castle, Pa.—An ordinance has been passed for grading and paving Mercer and Lawrence sts.

Canton, O.—Bids are asked until Jan. 8 for the purchase of street improvement bonds. Cy. Audt.

Chester, Pa.—Asphalt paving is contemplated for 5th and Market sts. B. G. La Lomus cy. engr.

Superior, Wis.—City engineer Banks has prepared estimates for paving 16th and 11th sts. with macadam.

Clinton, Ind.—Bids will be asked soon for constructing 37 miles of gravel road in Railroad twp. Co. comrs.

Indianapolis, Ind.—Resolutions have been prepared for paving and improving a large number of streets.

Dowagiac, Mich.—City comrs. voted Dec. 3 to pave Front, High, Main, Green, Division and other streets.

Clinton, Ia.—Council is considering the question of curbing and macadam paving on 3d ave from 5th to 6th.

Grand Forks, N. D.—The different kinds of paving materials are being considered by this city for next season.

Winona, Minn.—The city engineer has been directed to prepare plans for macadam paving on W. 4th and Wilson sts.

Independence, Mo.—A large amount of asphalt paving will be constructed here during 1907. R. T. Proctor, cy. engr.

Fond du Lac, Wis.—The property owners on W. 2d, Military, Union and Sophia sts. are in favor of tar macadam paving.

St. Louis, Mo.—Hearing will be given Jan. 8 on the proposed construction of 3 miles of wood block paving on down town streets.

La Crosse, Wis.—The special street improvement com. decided Dec. 5 to contract 3 miles of vitrified brick and macadam paving.

East Liverpool, O.—Resolutions have been passed for paving Monroe, 3d and Ida sts. with vitrified brick. W. V. Blake mayor.

Topeka, Kan.—The property owners in North Topeka have petitioned for 7 blocks of paving on Holman, Saywell and Logan sts.

Grand Rapids, Mich.—The property owners in Fountain st. from Lafayette to Union have decided on creosoted wood block paving.

Rockhill, S. C.—The town contemplates the construction of $40,000 worth of imitation stone sidewalks. John G. Anderson interested.

Chicago, Ill.—A petition is being circulated among down town business men asking that the shopping district of State st. be boulevarded.

Des Moines, Ia.—Geo. L. Dobson, cy. engr., will require all future paving between street car rails to be laid with creosoted wood blocks.

McDonald, Pa.—Petitions are being circulated asking that the question of issuing $25,000 bonds for paving certain sts. be voted on.

St. Joseph, Mo.—An ordinance will be introduced in April for constructing artificial sidewalks on both sides of Francis st. from 29th to 30th.

Natchez, Miss.—Alderman Berdon favors vitrified brick paving for the business section and bitulithic for the residence districts of this city.

Titusville, Pa.—Bids will be asked in the spring for 23,500 sq. yds. of asphalt block, asphalt, wood block, or brick paving on Main st. H. A. Holstein, cy. engr.

East St. Louis, Ill.—An ordinance was passed Dec. 17 for paving Cleveland ave. from 11th to 16th sts with vitrified brick. The improvement of 9th st. and Veronica ave. is also contemplated.

Sharpsville, Pa.—Special.—L. H. Phelps, cy. engr. and sur., says this city will do about 1 mile of paving in the spring and would like to have some up to date information on brick pavements.

Bartlesville, I. T.—Special.—W. H. Whaley, cy. engr., says bids will be asked soon for 7 blocks of street paving and he desires to communicate with paving contractors. Wm. T. Sidell, Mayor.

Ft. Wayne, Ind.—The bd. of pub. wks. has authorized the city engineer to prepare plans for paving E. Washington st. and Creighton ave. and the contract will be let in time for work to begin as soon as the weather is favorable.

Cleveland, O.—Bids will be asked for brick paving and curbing E. 61st, Cowan, E. 48th, E. 64th and E. 66th sts. and Doroy road and Carpenter ave., Glenwood and Butler aves. will be paved with brick in the spring. W. J. Carter, cy. engr.

Kansas City, Mo.—The down town alleys are to be paved under the charter provision which gives the board of public works power to have them paved as business alleys by the council concurring in a resolution to that effect. Cy. engr. Harper.

CONTRACTS TO BE LET.

Miles City, Minn.—Bids are asked until Jan. 5 for building a cement sidewalk. Cy. clk.

Titusville, Pa.—Bids are asked until Feb. 1 for paving streets. H. A. Holstein, cy. engr.

Bedford, Ind.—Bids are asked until Jan. 8 for constructing various gravel roads. Co. comrs.

Rockville, Ind.—Bids are asked until Jan. 9 for constructing gravel roads. Henry Brubb, Co. Audt.

Bloomington, Ind.—Bids are asked until Jan. 9 for constructing a gravel road. S. M. Kerr, Co. Audt.

Princeton, Ind.—Bids are asked until Feb. 1 for constructing 11 miles of gravel road. Harry R. Embree, Co. Audt.

Columbus, Ind.—Bids are asked until Jan. 8 for constructing 1 mile of gravel road in Hawcreek twp. Wm. A. Morris, Co. Audt.

Steubenville, O.—Bids are asked until Jan. 4 for paving Washington st. with Hillside block. T. W. Vance, clk. B. P. S.

Cincinnati, O.—Bids are asked until Jan. 4 for grading and setting curbing in Lawrence alley. M. J. Keefe, clk. B. P. S.

Terre Haute, Ind.—Sealed bids are asked until Jan. 5 for grading and graveling certain roads. Jerome W. Deuehle, Co. Audt.

Bloomfield, Ind.—Bids are asked until Jan. 8 for constructing gravel and macadamized roads in Wright twp. Wm. H. Dickard, Co. Audt.

Amityville, N. Y.—Sealed bids are asked until Jan. 7 for macadamizing and otherwise improving Broadway and Park ave. W. B. Inglee, vil. clk.

Valparaiso, Ind.—Bids are asked until Mar. 8 for constructing cement curbing and gutters in Morgan, Michigan and Water sts. Robert Ewing, cy. clk.

Versailles, Ind.—Sealed bids are asked until Jan. 8 for constructing macadamized roads in Brown, Washington, Laughery and Otter Creek twps. Nicholas Volz, Co. Audt.

Knox, Ind.—Sealed bids are asked until Jan. 7 for macadamizing and graveling a road including grading, 6 corrugated steel culverts and 2,553 sq. yds. of gravel. Lee M. Ransbottom, co. audt.

Troy, O.—Sealed bids are asked until Jan. 8 for 35,400 sq. yds. of paving on the public square and two main sts. Specifications will be mailed to any party desiring to bid. L. A. Ziegenfelder, clk. B. P. S.

Cleveland Heights, O.—Bids are asked until Jan. 15 for macadamizing and constructing sidewalks on Stratford road. Wm. E. Phare, vil. clk., Am. Trust bldg., Cleveland, F. A. Pease Engr. Co., 931 Williamson bldg., Cleveland, O.

Norfolk, Va.—Sealed bids are asked until Jan. 10 for paving Colonial and Jamestown aves. with asphalt or bitulithic on concrete base, with granite curbing, constructing macadam roadway on Colley ave. W. T. Brooks, cy. engr. for boulevard comrs.

Newburgh, N. Y.—Sealed bids are asked until Jan. 7 for paving 8,200 sq. yds. of Lander st. with vitrified block, asphalt block or Warren's bitulithic pavement, with curbstones, catch basins, sewers, manholes, etc. D. J. Coutant, cy. clk.; Everett Garrison, cy engr.

CONTRACTS AWARDED.

Troy, N. Y.—John H. Gleason was awarded a contract for paving Pawling ave. with brick for $23,743.

Dallas, Tex.—The contract for paving Akard st. with bitulithic was awarded to the Texas Bitulithic Co.

Newark, O.—Brennan & Muter, of this city, was awarded a contract for 17,200 sq. yds. of brick paving for $21,312.

Terre Haute, Ind.—The contracts for constructing the Maxville grade was awarded to Don M. Roberts for $29,890.

Duluth, Minn.—A contract for macadamizing 24th st. including sewers and grading was awarded to P. McDonnell, for $24,579.

Kirksville, Ind.—The contract for 2,500 sq. yds. of bitulithic paving was awarded to the Hoosier Constr. Co., of Indianapolis.

Little Rock, Ark.—The contract for curbing, guttering and macadamizing W. 12th st. was awarded Dec. 4 to Zeb Ward for $16,049.

Portland, Ore.—A contract for improving Deukin ave was awarded Dec. 1 to Stephens Bros. for $9,928 and Harry Howard for $6,095.

Tacoma, Wash.—The contract for grading and constructing sidewalks on Puget Sound ave was awarded to B. W. Kidler for $9,730.

Wilkesbarre, Pa.—W. J. Cahoon & Co. secured the contract for paving Kidder st. at $1.90 per sq. yd. and $1.79 a lin. ft. for curbing.

Beallsville, Pa.—The contract for constructing a new state road through here was awarded to N. C. Hunter, of Brookville, for $16,248.

Los Angeles, Cal.—A contract for furnishing granite paving blocks was awarded to the Fairchild-Wilton-Gilmore Co., of Corona, for $20,000.

Franklin, Pa.—The contract for constructing 6,400 ft. of macadamized road in Hempfield twp. was awarded to John L. Hanna, of this city, for $13,485.

Brooklyn, N. Y.—A contract for building the municipal asphalt plant at Brooklyn, N. Y., was awarded to the Warren Asphalt Company at $22,485.

Edmonton, Alberta, Can.—A contract for 55,000 sq. yds. of bitulithic has been

awarded the Warren Bituminous Paving Company, of Toronto, Ont.

St. Louis, Mo.—The Granite Bituminous Paving Company, of St. Louis, has received an additional contract for 42,429 sq. yds. of bitulithic.

Niagara Falls, N. Y.—The Warren Brothers Company, of Boston, will lay 21,200 sq. yds. of bitulithic.

Scranton, Pa.—An additional contract for 2,518 sq. yds. of bitulithic has been awarded the Standard Bitulithic Company.

Dallas, Texas.—The Texas Bitulithic Company has received a contract for 23,694 sq. yds. of bitulithic.

Toronto, Ont.—A contract for 11,711 sq. yds. of bitulithic has been awarded to the Warren Bituminous Paving Company.

Indianapolis, Ind.—The Hoosier Construction Company has been awarded a contract for 6,000 sq. yds. of bitulithic.

Spartansburg, S. C.—A contract for 10,886 sq. yds. of bitulithic has been awarded the Atlantic Bitulithic Company.

Mobile, Ala.—The Southern Bitulithic Company has received a contract for 5,307 sq. yds. of bitulithic in addition to the 40,000 yds. recently announced.

South Bethlehem, Pa.—The Standard Bitulithic Company, of New York, has received a contract for 23,311 sq. yds. of bitulithic.

Asheville, N. C.—The Atlantic Bitulithic Company has been awarded a contract for 6,500 sq. yds. of bitulithic.

Knoxville, Tenn.—The contract for constructing from 1,500 to 2,000 sq. yds. of granolithic sidewalks in Piedmont Place Addition was awarded to Joseph Armstrong.

Delaware, O.—The contract for constructing Maple street paving was awarded to J. T. Hutchinson & Son for $1,340.79, and for Noble street to Clarence Hazleton for $946.40.

New Albany, Ind.—The Barber Asphalt Paving Co. has been awarded a contract for paving Culbertson ave., from Vincennes to Silver st., at $4.29 per lin. ft. on each side of street.

Birmingham, Ala.—The contract for sidewalk paving was awarded Dec. 5 to R. Blackburn, and for grading, curbing and concrete gutter paving to Dunne and Lalland Bros. for $4,624.

Norfolk, Va.—The contract for paving the war path and other sidewalks at the Jamestown Exposition grounds, with vitrified brick, has been awarded to Wainright, Jackson & Co.

South Bethlehem, Pa.—The contract for paving three streets was awarded to the Warren Bros. Co., of Boston, Dec. 10, the style of paving to be determined by the boro engr. and st. comr.

Atlantic City, N. J.—A contract for paving of cross town streets was awarded Dec. 10 to G. P. Murray, of Brooklyn, for $162,169.29. Macadam, brick and telford will be used, with blue stone granite curbing.

Montgomery, Ala.—Paving contracts were awarded Dec. 17 as follows: Caroline and Wilson sts., asphalt, Memphis Asphalt & Paving Co., $8,032 and $3,376 respectively: Montgomery st., bitulithic, Southern Bitulithic Co., of Birmingham, $17,765.

Oklahoma City, Okla.—The Frank L. Adams Co. secured the contract for grading Laird ave and 9th st. Bids received Dec. 17 for paving in several new districts were rejected as too high. The cy. engr. has been directed to communicate with some new paving companies. The Barber Asphalt Co.'s bids ranged from $2.19 to $2.21 per sq. yd., and the Trinidad Asphalt Co.'s bid was $2.25 per sq. yd.

SEWERS.

Vincennes, Ind.—The property of the Vincennes Sewer Co., which went into bankruptcy, will be purchased by Orlando H. Cobb, William J. Nicholson, J. S. Spiker and Daniel W. Norton, who will organize a company to be known as the Indiana Sewerage Co.

CONTEMPLATED WORK.

Brampton, Ont.—Sewerage system will be installed.

Welland, Ont.—Extension of sewerage system is contemplated.

Sumpter, S. C.—Voted to issue $50,000 bonds for a sewerage system.

South Haven, Mich.—Bids will be asked for building sewer on Hubbard st.

Hattiesburg, Miss.—Will issue bonds for the extension of sewerage system.

Stratford, Ont.—Sewerage system is contemplated at a cost of about $16,500.

Waco, Texas.—Voted to issue $60,000 bonds for the extension of the sewerage system.

Stamford, Texas.—A sewerage system is contemplated. No engineer has been selected yet.

Hamilton, Ont.—The construction of sewers and a sewage disposal plant is proposed.

Sandersville, Ga.—This city voted to issue bonds for constructing a sewerage system.

Winchester, Ky.—This city will issue $40,000 bonds for constructing a sewerage system.

Kendallville, Ind.—The question of improving the sewerage system is being considered.

Wapello, Ia.—A 12-in. pipe sewer continuing into an 18-in. sewer is contemplated on Isett ave.

Rushville, Ind.—About 11 miles of 6 to 24-in. sewers will be built. Alonzo L. Stuart, cy. engr.

Millville, N. J.—This city has been ordered by the State Sewer Com. to construct a sewer system.

Salem, O.—Council will issue bonds for construction of trunk line sewer. Halbert Carlile, Mayor.

Portsmouth, O.—The construction of vitrified sewers is contemplated. B. C. Bratt, cy. engr.

Alton, Ill.—Ordinances have been prepared for constructing sewers in a large number of streets. Mayor Beal.

Medina, N. Y.—Plans have been prepared for constructing a sewer for the East side. W. B. Eckert, vil. clk.

East Liverpool, O.—Plans and estimates will be prepared at once for sanitary and storm sewers on several streets.

Danvers, Ill.—The question of sewerage system is being discussed and an engineer will be engaged to make plans.

Fond du Lac, Wis.—Bids will be asked after Feb. 1 for constructing 12 miles of sewers. L. A. Pettybone, cy. engr.

Kokomo, Ind.—It is believed that a new and complete sewerage system will be constructed next summer. Mayor Arnet.

Bloomington, Ind.—The question of constructing a sewerage system is again under discussion. Cv. engr., Hanna.

Watertown, N. Y.—Plans have been

prepared for a trunk sewer to drain the western part of the city at a cost of $80,000.

Dundee, Ill.—Surveys for sewerage system in West Dundee will be prepared by Anderson & Scheflow, engineers, Elgin, Ill.

Taylorsville, Ill.—The construction of 1 and 2-10 miles of 14 to 16 inch tile sewer in Shawnee street is contemplated. W. Dappert, engineer.

Lake Charles, La.—A proposition to install $100,000 sewerage system has been submitted to the council by J. A. Landry and associates.

Collinsville, Mo.—The Bd. of Loc. Impvts. voted in favor of an ordinance to build a complete sewerage system for $22,000 and a septic tank for $5,000.

Minden, Neb.—Plans and specifications for a sewerage system will be made by Burns & McDonnell, of Kansas City, Mo., and bids will be received in spring.

Oxford, O.—Plans have been submitted to State Board of Health for the proposed sewerage and sewage purification plant. Alex. Potter, N. Y. City, Cons. Engr.

Evansville, Ind.—The construction of 1,700 ft. of reinforced concrete sewers 4 to 6 ft. in diameter in Kentucky ave is contemplated. Jas. D. Saunders, cy. engr.

Norristown, Pa.—Bids will probably be asked soon for about 1,200 ft. of 8-in. sewer with flush tank under De Kalb st., and 800 ft. on Beach st. S. Cameron Corson, cy. engr.

Akron, O.—Cy. engr. Payne has completed plans for changing the main outlet of city sewage to a point 1,000 ft. further down the little Cuyahoga, at a cost of $2,125.

Indianapolis, Ind.—Plans are being prepared for 7,500 ft. of sewer in Sherman ave at a cost of $40,000 to $50,000. The sewer will be 5½ ft. in diameter and will be constructed of concrete or brick.

Dunkirk, N. Y.—Common council will consider the question of constructing a trunk sewer to prevent the city sewage from going into Lake Erie, during 1907. John T. Madigan, Mayor; Lewis N. Murray, cy. clk.

Toronto, Ont.—Plans for a trunk sewer system have been submitted to the provincial Bd. of Health. The board has approved the section of intersecting sewers as far as Woodbine ave. The question of outfall and the final disposal of the sewage will be determined later on. C. H. Rust, cy. engr.

Bridgeport, Conn.—The question of constructing an improved sewerage system at a cost of $25,000 is under consideration. Plans for sewerage system will be prepared by Arthur Pew, of Atlanta, Ga. Bonds will be voted after the plans and estimates are completed.

La Mar, Colo.—Special.—C. R. Beardsley advises us that this town is preparing to construct a sewer system and will ask for bids the first of the year. There will be about 13 miles of sewer ranging from 8-in. to 2½ ft. and possibly larger. The outlet sizes have not yet been determined upon.

CONTRACTS TO BE LET.

Rolla, Mo.—Bids are asked until Jan. 7 for constructing sewers. McRae & Harris, engrs.

Cedar Falls, Ia.—Sealed bids are asked Jan. 22 for constructing storm water sewers. F. X. Miller, chmn. sewer com.

Winnipeg, Man.—Bids are asked until Jan. 4 for constructing a concrete trunk sewer. H. N. Ruttan, cy. engr.

Syracuse, N. Y.—Bids are asked until Jan. 2 for constructing the Elm Wood Dist. sewer system. H. H. Bruster, engr.

Saint Mary's, O.—Bids are asked until Jan. 30 for constructing a sanitary sewer system. Riggs & Sherman, Toledo, engrs.

Wichita, Kas.—Sealed bids are asked until Jan. 24 for constructing Wichita storm water sewer No. 5. R. N. Dore, cy. clk.

Beresford, S. D.—Bids are asked until Jan. 7 for constructing 700 ft. of 8-in. and 500 ft. of 6-in. sewer. H. A. Sturges, cy. audt.

Merchantville, N. J.—Sealed bids are asked until Jan. 12 for constructing a system of sanitary sewerage. A. W. McCallum, chmn. sewage com.

Burlington, Ia.—Sealed bids are asked until March 18 for constructing the Locust st. vitrified sewer and branches. J. F. Winter, cy. engr.

Cape Girardeau, Mo.—Sealed bids are asked until Feb. 4 for constructing 12 miles of 8 to 22-in. pipe sewers with appurtenances. Wm. H. Curveour, mayor.

Oakland, Cal.—Bids are asked until Jan. 7 for building two brick sewers, three concrete sewers and one ironstone pipe sewer. W. B. Fawcett, secy. B. P. W.

Bisbee, Ariz.—Sealed bids are asked Dec. 15 for constructing sewerage and water system and sewage disposal plant. Cleveland W. Van Dyke, mgr. Warren Co.

Webb City, Mo.—Bids are asked until Jan. 7 for constructing 1,999 ft. of 8-in. sewer, 177 Y junctions, 6 manholes and 1 flushtank. W. E. Smith, cy. engr.

Toledo, O.—Bids will probably be received about April 1 for 1-4 mile of 24 to 72-in. brick and concrete relief sewer. F. I. Consaul, chief engr.

Rosemond, Ill.—Bids are asked until Jan. 2 for constructing a three mile 8 to 6-in. tile drainage ditch for the highway comrs. J. W. Dappert, engr., Taylorville, Ill.

CONTRACTS AWARDED.

Washington, D. C.—E. G. Gummel was awarded the contract for constructing sewers for $40,358.

St. Paul, Minn.—The contract for building sewer in Michigan st. was awarded to J. M. Thornton for $4,583.

Terre Haute, Ind.—A contract for constructing the N. 6th st. sewer was awarded to Wm. J. Earler, for $2,927.42.

Omaha, Neb.—The contract for building the Mud Creek sewer was awarded to the National Construction Co.

Baltimore, Md.—The contract for constructing the sewage pumps was awarded to the Bethlehem Steel Co. for $450,000.

Apalachicola, Fla.—Contract for constructing 9,000 ft. of sewer was awarded to Bryan & Co., of Jacksonville, for $8,838.50.

Lebanon, O.—The contract for constructing trunk sewers was awarded Dec. 7 to Samuel Monroe & Sons, of Portsmouth, for $3,884.

Greenville, N. C.—Contract for constructing sewers was awarded to the Burt-Casson Construction Co., of Gloversville, N. Y., for $13,410.

Parsons, Kas.—The contract for building the North end sewer was awarded the Plunket Construction Co., of Coffeyville, Kas., for $12,950.

Norwood, O.—Contract for construct-

ing sewers in Forest, Ridgewood and Floral aves. in East Norwood and Beach sts. was awarded to the Kirby Realty Co. for $20,810.

Glen Gardner, N. J.—The contract for sewage disposal plant at the Sanitorium here was awarded to the New York Sewage Disposal Co., of New York city, for $6,740.

Davenport, Ia.—The contract for constructing the first section of the new Rock Island sewer system was awarded to the Pepples Construction Co., of this city, for $60,000.

Long Island City, N. Y.—Sewer contracts have been awarded as follows: 11th and Vandeventer aves., Gabriel Hill, $15,553; Clark st. and Canal st., Thomas Welch, $13,189; 3d ave., Peach Bros., $4,739; 20th st., H. J. Mullins, $3,391.

Birmingham, Ala.—C. M. Burkhalter was awarded a contract for constructing the Woodlawn branch of the sewer in North Birmingham for $7,333, and Dunn & Lallande Bros. secured the contract for repairing the village creek sewer for $8,950.

WATER WORKS.

Flint, Mich.—The waterworks plant has just completed its third year under municipal ownership. The balance of the credit of the water commissioners is $9,244, which represents the net earnings of the plant since it was taken over by the city from a private corporation three years ago.

CONTEMPLATED WORK.

Andrews, N. C.—Voted to issue waterworks bonds.

Elmira, Ont.—Will construct waterworks system.

Lake Andes, S. D.—A waterworks system is proposed.

Windcave, S. D.—A waterworks system is proposed.

Virginia Beach, Va.—A waterworks and sewerage system are contemplated.

Prattville, Ala.—Will vote on issue of $30,000 bonds for waterworks.

Battle Lake, Minn.—Question of waterworks system is being agitated.

Hattiesburg, Miss.—Will issue bonds for the extension of the water system.

Fremont, Neb.—The installation of a complete waterworks system is proposed.

Oakhart, Ill.—The village board decided Dec. 6 to build a municipal waterworks plant.

Tuscaloosa, Ala.—Voted to issue bonds for constructing waterworks. F. G. Blair, mayor.

Kearney, Neb.—Will vote on issue of bonds for construction of waterworks in April.

Brantford, Ont.—Will vote on the issue of $40,000 bonds for erecting a pumping station.

Frontenac, Kas.—Voted to issue bonds for constructing a municipal waterworks system.

Natchez, Miss.—The waterworks commission has decided to construct a wooden reservoir.

Sandersville, Ga.—Voted to issue bonds for extending waterworks and electric light system.

Andrews, Ind.—Another attempt has been made to organize a light and waterworks company here.

Lesterville, N. Y.—Will vote in March on the issue of bonds for a pumping system for the waterworks.

Chicago, Ill.—The sanitary board is planning another water power plant at Braydon road, 2 1-2 miles from Joliet.

Bangor, Me.—An expert will be engaged to prepare plans for the proposed filter plant at the pumping station.

Pomona, Cal.—Will vote on the question of issuing bonds to acquire municipal ownership of the water system.

Leavenworth, Kas.—An appropriation of $53,000 has been recommended for installing a municipal waterworks system.

Wynnewood, I. T.—Will vote Jan. 18 on issue of $8,000 bonds for the extension of the waterworks system, etc.

Bluffton, Ind.—City council voted Dec. 11 to purchase 2 new boilers for city waterworks and electric light plants.

Ballinger, Tex.—Special.—R. T. Maddox, chmn. water co., is in market for 1 pump and possibly 1 boiler for this city.

Cuyahoga Falls, O.—Council is authorized to expend $10,000 for new apparatus in the pumping and lighting station.

Abbeville, La.—Special.—H. P. Porter, cy. engr., is in the market for supplies for waterworks and electric light system.

London, Ont.—This city is considering the question of expending $570,000 for waterworks extension. Ormsby Grayden, cy. engr.

Seattle, Wash.—Plans and specifications for enlarging the municipal water-supply have been completed by R. H. Thompson, cy. engr.

Bristol, Tenn.—Legislature will be asked to authorize a $300,000 bond issue to purchase and enlarge the city waterworks plant, now owned by a private corporation.

Peoria, Ill.—The village of Peoria Heights offers $15,000 worth of water mains to any company or corporation which will erect a water power plant within the village limits and furnish power and water to the citizens.

Springfield, Mass.—The work of construction for the water supply system for this city, from Little river, will begin soon. A distributing reservoir at an elevation which will raise the pressure materially in the residence district is proposed.

East Grand Forks, Minn.—Council contemplates the construction of a pipe from the river to the lighting station to furnish water for the use of the plant. The question of constructing a complete water system may be taken up by the city.

CONTRACTS TO BE LET.

Pineville, La.—Bids are asked until Jan. 15 for constructing a waterworks system. O. F. Hibble, mayor.

Jonesville, La.—Bids are asked from Jan. 2 for sinking an artesian well. T. M. Mathews, mayor.

Bloomfield, N. J.—Bids are asked until Jan. 1 for laying new water mains. Wm. L. Johnson, town clk.

Rolla, Mo.—Bids are asked until Jan. 7 for constructing a waterworks system. McRae & Harris, engrs.

Elkhart, Ind.—Bids are asked until Jan. 10 for supplying this city with water for 25 years. B. P. W.

Norwood, O.—Bids are asked until Jan. 7 for furnishing 1,000 5-8 in. water meters and connections. B. P. S.

Muskegon, Mich.—Sealed bids are asked until Jan. 28 for furnishing two pumping engines, steam or electric power. Water com.

Albuquerque, N. M.—Bids were asked Nov. 5 for furnishing water pipe hydrants

pumps, motor, etc. Burton B. Custer, supt.

Winnepeg, Man.—Bids are asked until March 1 for supplying 30 miles of assorted water pipe and a quantity of specials. H. N. Ruttan, cy. engr.

Lajunta, Colo.—Bids are asked until Jan. 22 for the construction of reservoir and embankment at Clear Creek, near Granite. Otero Irrigation Dist.

Kangley, Ill.—Bids are asked until Jan. 22 for 1,840 ft. 4-in., 1,780 ft. 2-in. pipe, connections, valves, hydrants, etc. Geo. Clay, village clk.

Bisbee, Ariz.—Sealed bids are asked until Jan. 15 for constructing a water and sewerage system and a sewage disposal plant. Cleve W. Van Dyke, mgr. Warren Co.

Meadville, Pa.—Bids are asked for Jan. 15 for furnishing and erecting at the pumping station a 2,500,000 gal. steam pump; also a 3,000,000 gal. steam pump. Henry Ellsworth, supt. water and light dept.

Philadelphia, Pa.—Sealed bids are asked until Jan. 4 for furnishing pumping engines for Lardner's Point pumping station No. 3; coal handling machinery and pockets for Torresdale pumping station. John R. Hathaway, dir. pub. wks.

New Orleans, La.—Bids are asked until Jan. 23 for furnishing, hauling and laying 50 miles of cast iron water pipes; for furnishing 38,000 tons of cast iron pipe and 1,100 tons of special castings. F. S. Shields, secy. sewerage and water board.

Mitchell, Neb.—Bids are asked until Jan. 24 for furnishing steel and cast iron pipe for use on the North Platte Irrigation Project; 125,500 lbs. of steel bars for reinforcement of concrete; 16,000 pounds of structural steel; about 50,000 pounds of cast iron gates, guides, spans, etc. U. S. Rec. Service.

CONTRACTS AWARDED.

Rome, N. Y.—The contract for 28 water meters was awarded to the Trident Meter Co. and the Pittsburg Meter Co.

Philadelphia, Pa.—A contract for installing six new boilers at Lardner Point pumping station No. 2 was awarded to the Edgemoor Iron Co., for $54,000.

Alliance, O.—John Calkins was awarded the contract for drilling test water works wells for the city waterworks plant for $5,000.

Westside, Ia.—The contract for constructing waterworks was awarded to the Des Moines Bridge and Iron Works of Des Moines, for $11,300.

BRIDGES.

Willimantic, Conn.—Voted to build a new steel bridge over Shetucket river, at South Windham.

St. Johns, Ore.—Plans have been prepared for a high bridge across Willamette river here.

Norfolk, Va.—W. T. Brooke, cy. engr., has prepared plans for 2 viaduct bridges across Newton's Creek.

Buffalo, N. Y.—The Niagara Frontier Bridge Co. was incorporated recently to bridge Niagara river at a point in Stamford.

Cohoes, N. Y.—The city engineer has been directed to prepare plans for a bridge to be built over Mohawk river at Ontario st.

Laconia, N. H.—City council has appropriated money for repairs to the present wooden bridge. Chas. A. French, cy. engr.

York, Neb.—Bids are asked until Jan. 7 for constructing wooden or steel bridges to be erected during 1907. W. A. Miller, co. clk.

Walla Walla, Wash.—Bids are asked until Jan. 9 for erecting a steel or wooden bridge over Touchet river on Johnson Bros. farm. Co. comrs.

Ottawa, Ill.—The city engineer has been directed to prepare plans for the removal of the old bridge over the Illinois river. Chas. E. Hork, mayor.

Hattiesburg, Miss.—Bids are asked until Jan. 8 for building a steel bridge over Big Black creek near Janice, Miss. T. E. Batson, clk. bd. supvs.

Memphis, Tenn.—Sealed bids are asked until Jan. 16 for erecting a steel girder bridge carrying Madison ave. over the Southern Ry. tracks. Jas. H. Malone, mayor.

Demopolis, Ala.—The Demopolis Improvement Co. has been incorporated to build a steel toll highway bridge across Black Warrior river here. John C. Webb, prest.

Cambridge, Mass.—Bids are asked until Jan. 2 for constructing a steel highway drawbridge across Lachmere canal on the line of Commercial ave. L. M. Hastings, cy. engr.

Creston, Ia.—Bids are asked until Jan. 9 for furnishing material and constructing all bridges required to be built in this county during the year 1907. W. F. Craig, co. audt.

Philadelphia, Pa.—The Ferro Concrete Co. of this city was awarded a contract for building a 50-ft. concrete arch bridge across Six-Penny creek, in Union twp., Berks county.

Lafayette, La.—Sealed bids are asked until Jan. 3 for plans and specifications for an iron drawbridge across Bayou Vermillion at or adjacent to the Darmas Broussard crossing. Felix H. Moulton.

Springfield, O.—The proposed bridge across Buck creek, connecting Sherman and Nelson st., may be built next year if the board of public service succeeds in securing an appropriation of $25,000 for the bridge fund.

Manistee, Mich.—Sealed bids are asked until Jan. 4 for furnishing, driving and capping 2 pile foundations; building 2 stone masonry or concrete abutments; clearing, repairing and painting an old 100 ft. span iron bridge; constructing a reinforced concrete bridge. Co. surv.

STREET LIGHTING.

Detroit, Mich.—Detroit Gas Supplies Co.

Panama, Ia.—An electric light plant is contemplated.

Pewaukee, Wis.—Voted to issue bonds for an electric light plant.

West Monroe, La.—Voted to issue bonds for an electric light plant.

Crawfordsville, Ga.—Voted to issue bonds for an acetylene gas plant.

Evansville, Ind.—Mayor Boehne is in favor of a municipal lighting plant.

Sandersville, Ga.—Voted to issue bonds for extending the electric light system.

Baker City, Ore.—The question of installing a light plant is being agitated.

Bellefontaine, O.—City council has decided to not sell the municipal gas plant.

Marquette, Mich.—The light and power

commission has adopted plans for a new electric light plant.

Danville, Ind.—James M. Lynch has purchased the local electric light plant and will reconstruct it.

New Haven, Conn.—The New Haven Gas Co. has been awarded a contract for street lighting for 3 years.

Newtown, Pa.—Bids are asked until Jan. 7 for lighting the streets for 3 or 5 years. Henry Aufflerbach, chmn. com. on light.

Canastota, N. Y.—The contract for lighting the streets for five years was awarded to the Central New York Power Co. of Utica.

Ashland, Wis.—A special committee from common council recommends municipal ownership of the light and power plant.

Abbeville, La.—Special.—H. Porter, cy. engr., is in the market for supplies for electric light and waterworks systems.

Wrightville, Ga.—Bids are asked until Jan. 2 for $25,000 waterworks and electric light bonds. J. E. Brindon, Jr., mayor.

Natchez, Miss.—Bids are asked until March 7 for lighting this city for a term of years. S. B. Stewart, chmn. light and water com.

Wessington Springs, S. D.—R. A. Bushnell, a local business man, has applied for a franchise for an electric light system here.

Wellington, Kas.—Bids will probably be asked next spring for improvements to the electric light plant. A. B. Cheever, cy. clk.

Coopersville, Mich.—A contract has been awarded the Grand Rapids-Muskegon Water Power Co. for lighting the streets of this village.

Nanticoke, Pa.—Bids are asked until Jan. 15 for constructing a power house, head and tail race. American Pipe Co., Philadelphia, Pa.

Newly incorporated electric light and power companies: Lena, Mo.—Lena Electric Light & Power Co., G. W. Benfer, H. D. Hinds and others.

East Liverpool, O.—Ohio Light and Power Co.—Walter B. Supplee, Dr. R. J. Marshall, Walter B. Hill and others.

Deer River, Minn.—The village council has appointed a committee to investigate the matter of installing an electric light plant here.

Noblesville, Ind.—The Noblesville Gas & Improvement Co. contemplates the erection of an artificial gas plant, to be in operation next spring.

Elyria, O.—The contract for enlarging the plant of the Dean electric light plant was awarded to the Osborn Engineering Co. of Cleveland.

Topeka, Kas.—This city has under consideration the remodeling of the present plant and the building of an entirely new plant. W. H. Davis, mayor.

Clay Center, Kas.—Bids are asked until Jan. 4 for 3 tubular boilers, 2 steam engines, generators, with exciters and switchboard. Geo. W. Hanna, mayor.

Litchfield, Ill.—The contract for lighting the streets was awarded to H. D. Smith, of the Illinois Traction Co., who will erect a large and modern lighting plant.

Missoula, Mont.—The Missoula Gas Co. has been incorporated and will begin the erection of a generating plant soon for furnishing artificial gas for heating and lighting.

Richmond, Va.—Sealed bids are asked until Feb. 1 for erecting building, machinery, apparatus, pipes, etc., for the rehabilitation and proper enlargement of the city gas works. W. P. Knowles, supt. com. on light.

Rusk, Tex.—The Rusk Electric Light Co. has been incorporated by T. H. Singletary, Sr., L. A. Huddleston, H. S. Guinn and C. H. Fitts. The company has purchased the local electric light plant and is remodeling and equipping it.

Milwaukee, Wis.—The American Street Lighting Co. submitted the lowest bid Dec. 15 for lighting the streets with gas, at $6.10 per lamp per year. The contract will be signed for one year, after which the lamps and burners are to become the property of the city.

Green Bay, Mo.—Sealed bids are asked until Jan. 3 for furnishing of street lighting with arc lights of 2,000 and 1,200 c. p. for ten years. Bids are also asked until Jan. 3 for furnishing gas and electricity for general municipal purposes for 5 and 10 years. J. E. Shaughnessy, chmn. gas and elect. light com.

Medina, N. Y.—The contract with A. L. Swett Electric Light & Power Co. for lighting the streets of this village expires Jan. 1. The present contract is $75 per lamp per year, but the company has offered to renew the contract at $70 per lamp per year. The board of trustees has offered the company $55, which was refused.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Winnipeg, Man.—The city incinerator plant was damaged by fire recently.

Asheville, N. C.—Voted to issue bonds for a garbage crematory. A. G. Holyburton, cy. clk.

Pensacola, Fla.—The bd. of pub. wks. has petitioned city council to appropriate money for the purchase of a garbage crematory.

Montclair, N. J.—The contract for the disposal of ashes and garbage in the 4th ward was awarded to Atworth & Son for $15,650.

Youngstown, O.—Council voted against the ordinance to give the garbage collection to the Youngstown Sanitary Co. without competition at $6.50 per ton, Dec. 10.

Chicago, Ill.—Wm. O'Connell, comrs. of pub. wks., asked for an appropriation of $25,000, Dec. 21, for installing a municipal incineration plant at the 14th st. pumping station.

FIRE APPARATUS.

Hawthorne, Wis.—The question of a fire department is being agitated.

Council Bluffs, Ia.—Council is considering the purchase of a fire engine.

Dunkirk, N. Y.—The fire and water com. are considering the installation of an electric fire alarm system. Definite action will be taken in January. Lewis N. Murray, cy. clk.